

FIG. 1

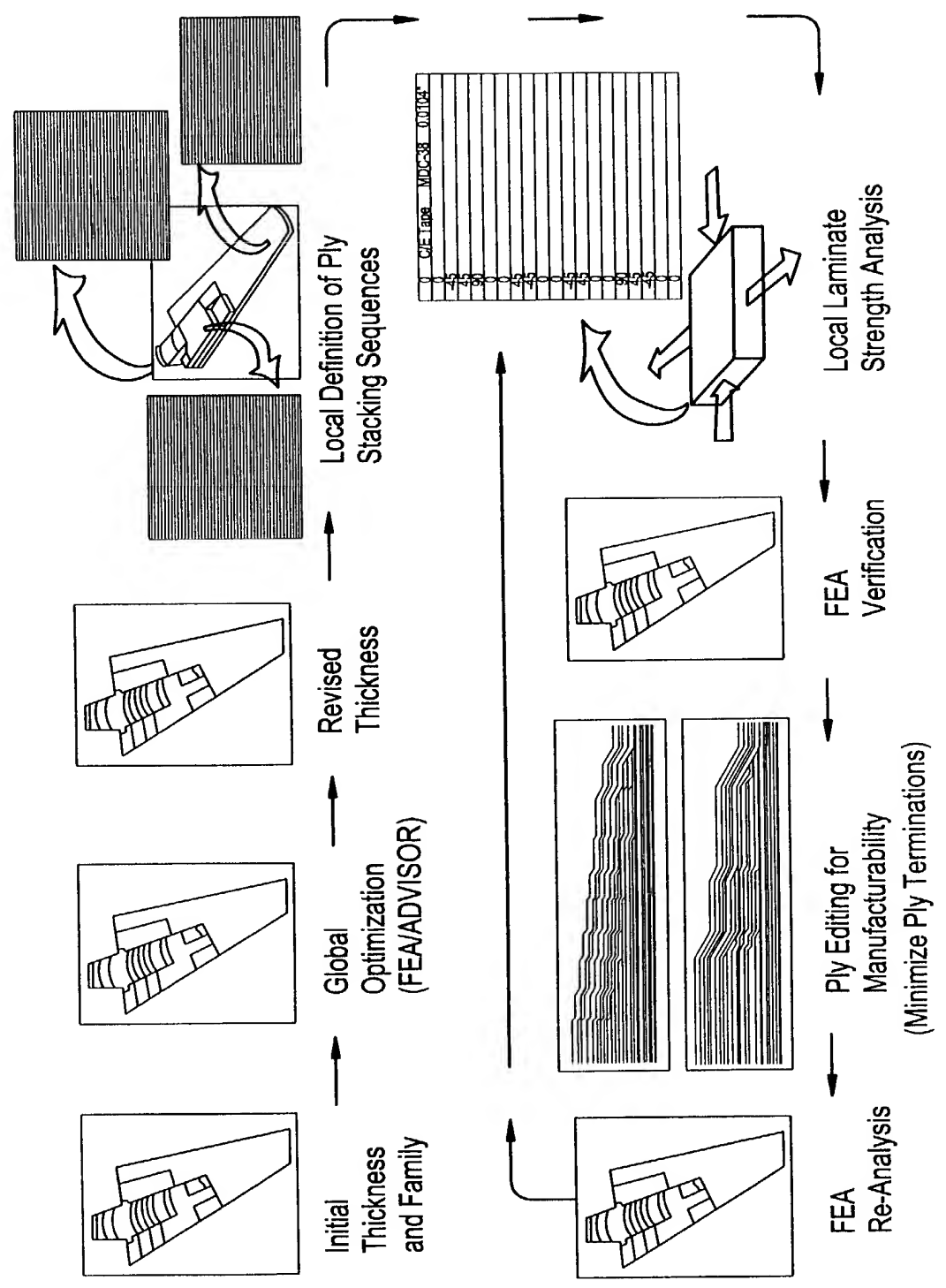


FIG. 2

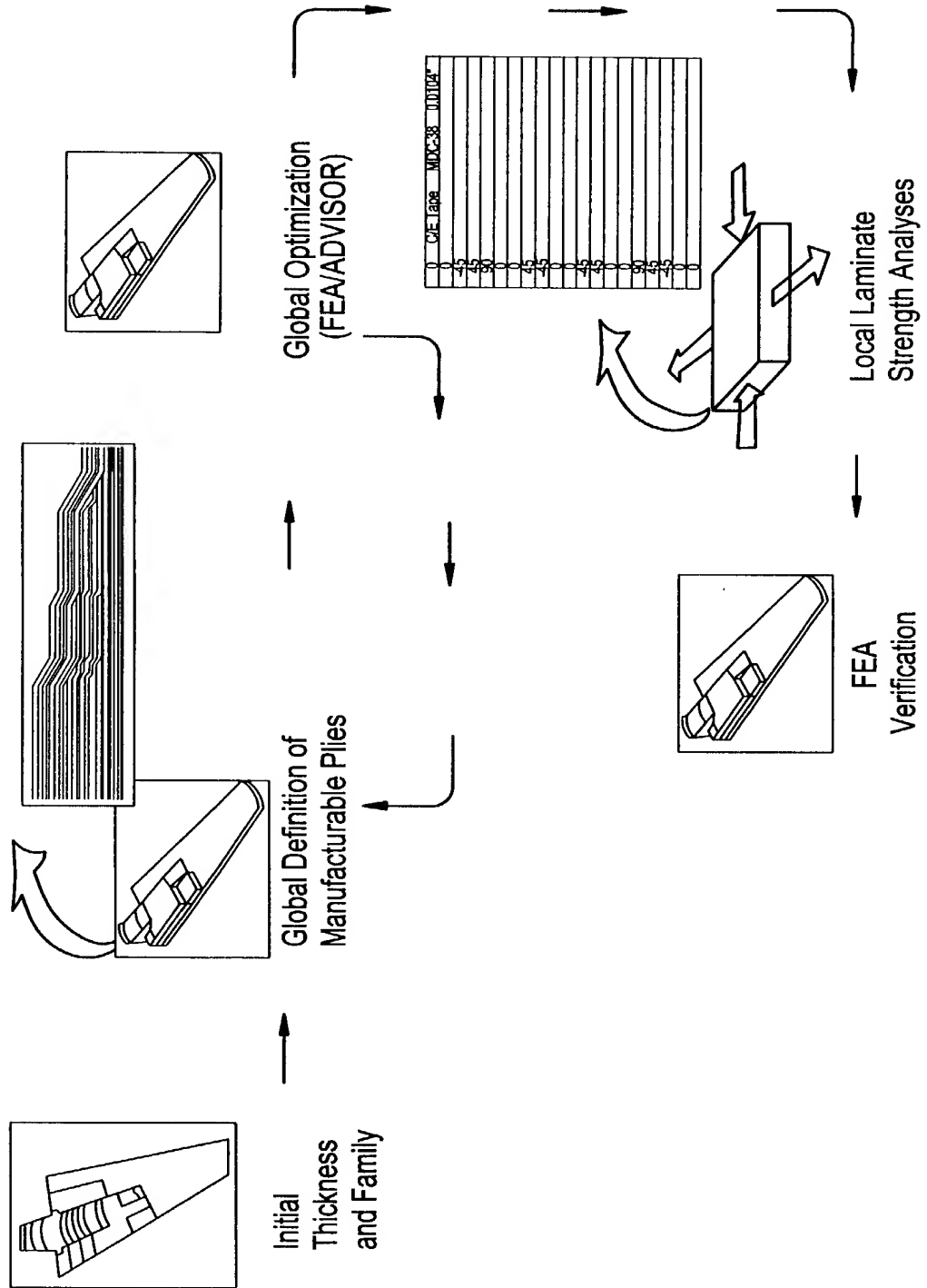


FIG.3

Thickness (# Plies)	Potential Families	Axial	Stiffness (msi) Transverse	Shear	Poisson's Ratio
17	--	13.23	5.30	2.79	0.42
18	--	13.23	5.30	2.79	0.42
19	--	13.23	5.30	2.79	0.42
20	50.0/40.0/10.0	13.23	5.30	2.79	0.42
21	--	13.23	5.30	2.79	0.42
22	--	13.23	5.30	2.79	0.42
23	--	13.23	5.30	2.79	0.42
17	41.2/47.1/11.8	11.59	5.88	3.14	0.42
17	47.1/47.1/5.9	12.56	4.68	3.14	0.52
18	44.4/44.4/11.1	12.19	5.67	3.01	0.42
19	42.1/42.1/15.8	11.78	6.60	2.89	0.35
19	47.4/42.1/10.5	12.74	5.48	2.89	0.42
19	52.6/42.1/5.3	13.61	4.39	2.89	0.52
20	50.0/40.0/10.0	13.23	5.30	2.79	0.42
21	42.9/38.1/19.0	11.90	7.10	2.69	0.30
21	47.6/38.1/14.3	12.80	6.12	2.69	0.35
22	45.5/36.4/18.2	12.38	6.86	2.61	0.30
22	54.5/36.4/9.1	14.07	4.97	2.61	0.42
23	47.8/34.8/17.4	12.82	6.64	2.53	0.30
23	52.2/34.8/13.0	13.65	5.74	2.53	0.35
23	56.5/34.8/8.7	14.44	4.83	2.53	0.41

FIG. 4

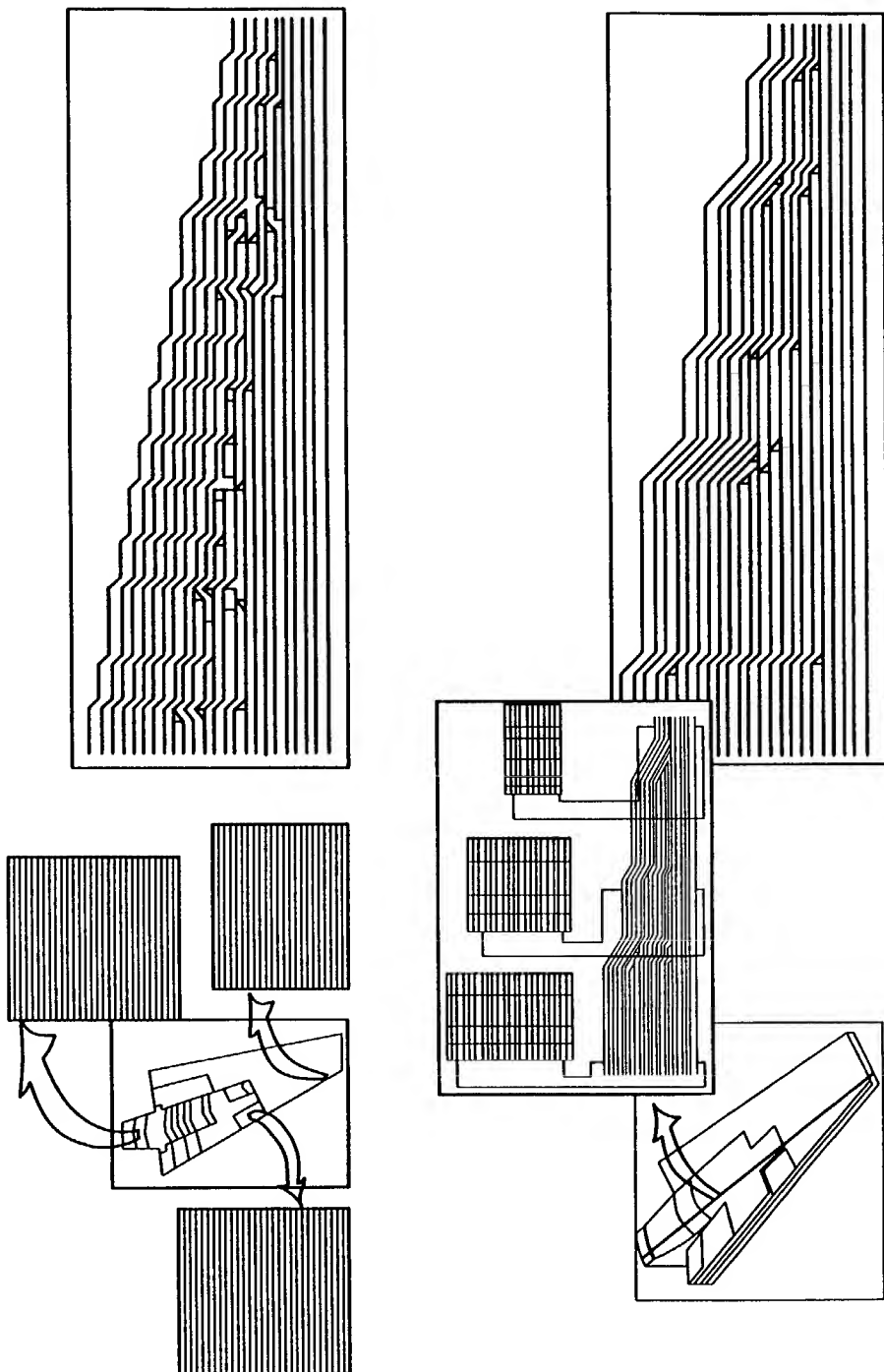
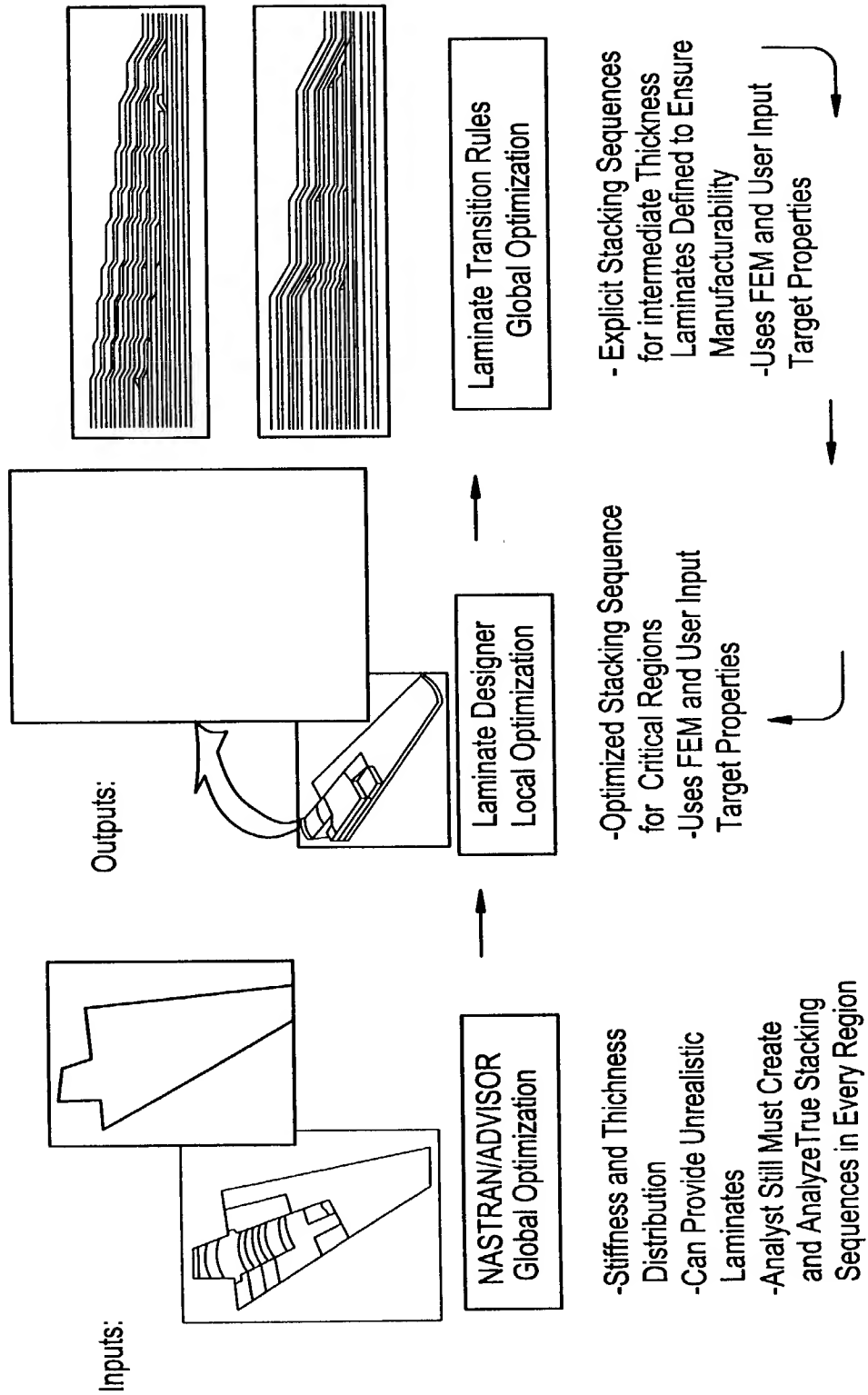


FIG. 5



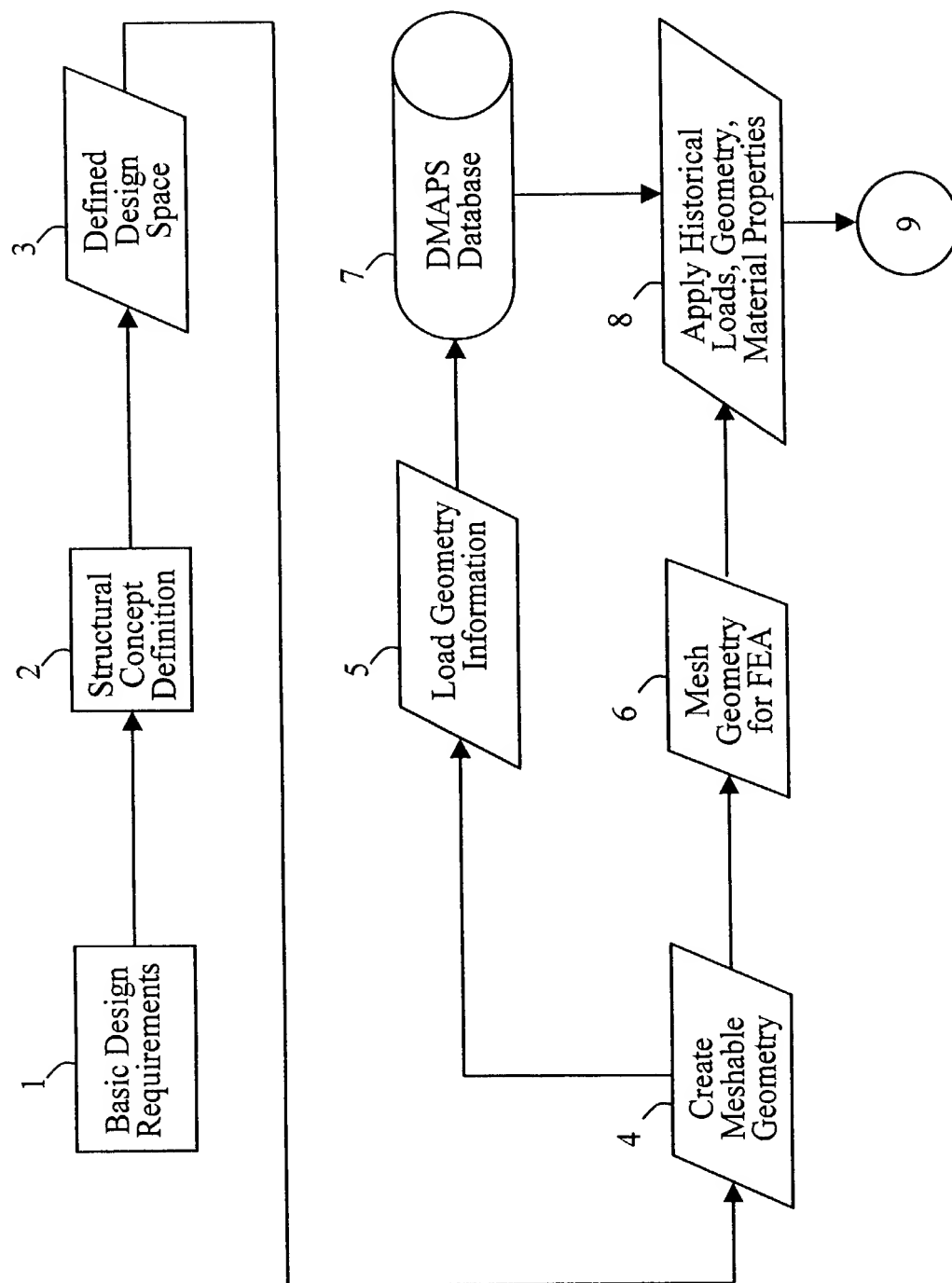
$$\begin{pmatrix} \frac{\partial}{\partial t} \\ \frac{\partial}{\partial x} \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} -v \\ u \end{pmatrix}, \quad \begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} \cos(x) \\ \sin(x) \end{pmatrix} \text{ at } t=0.$$


FIG. 7B

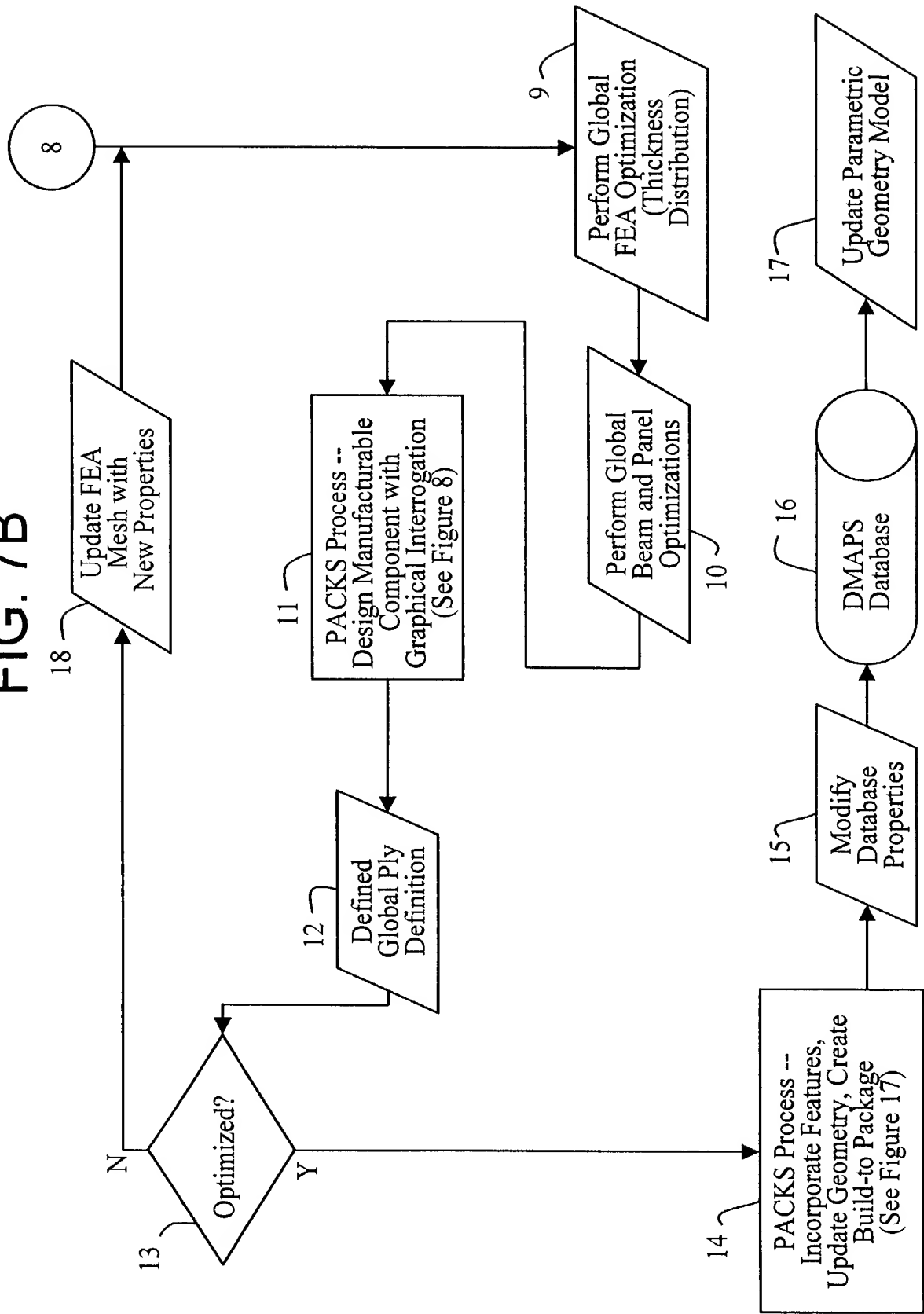


FIG. 8A

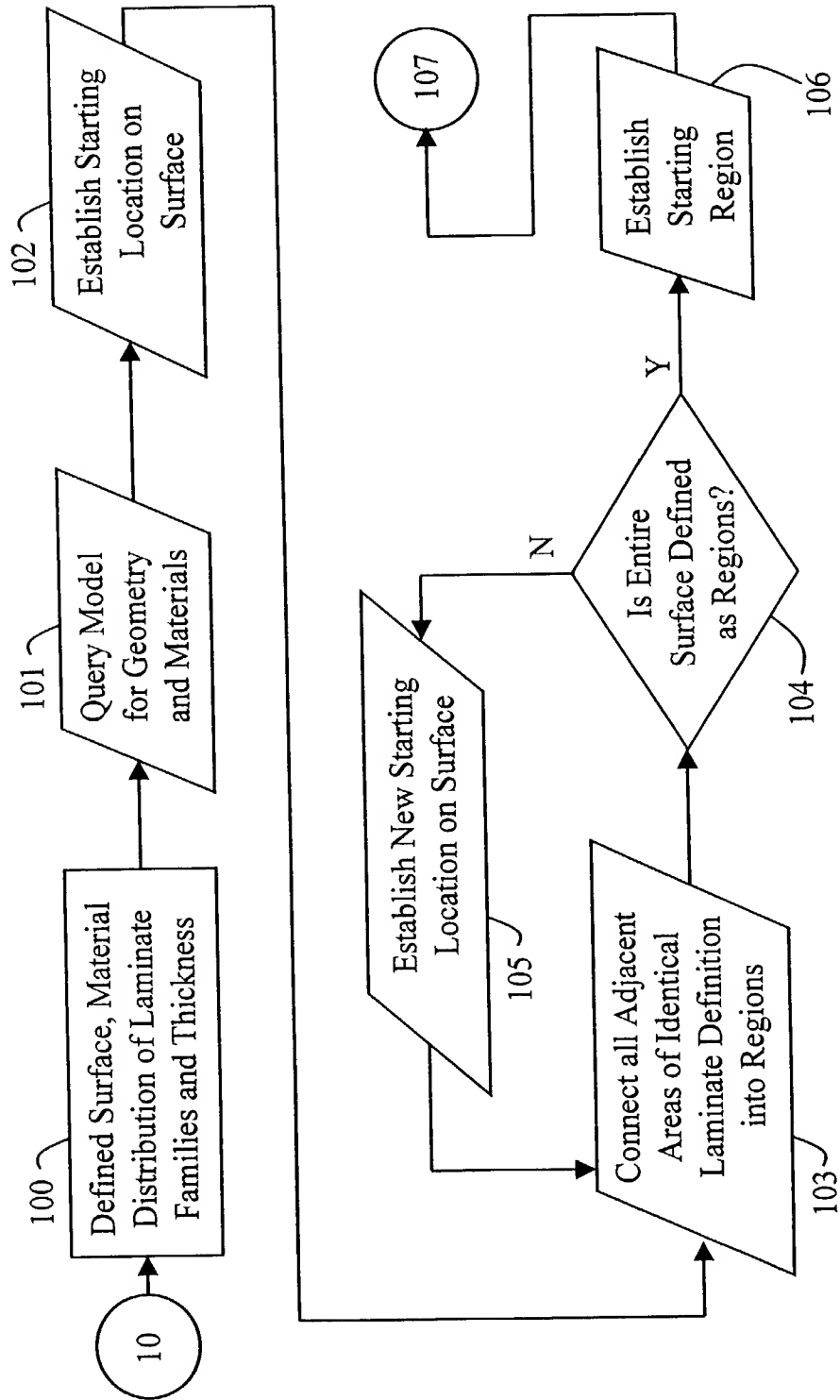


FIG. 8B

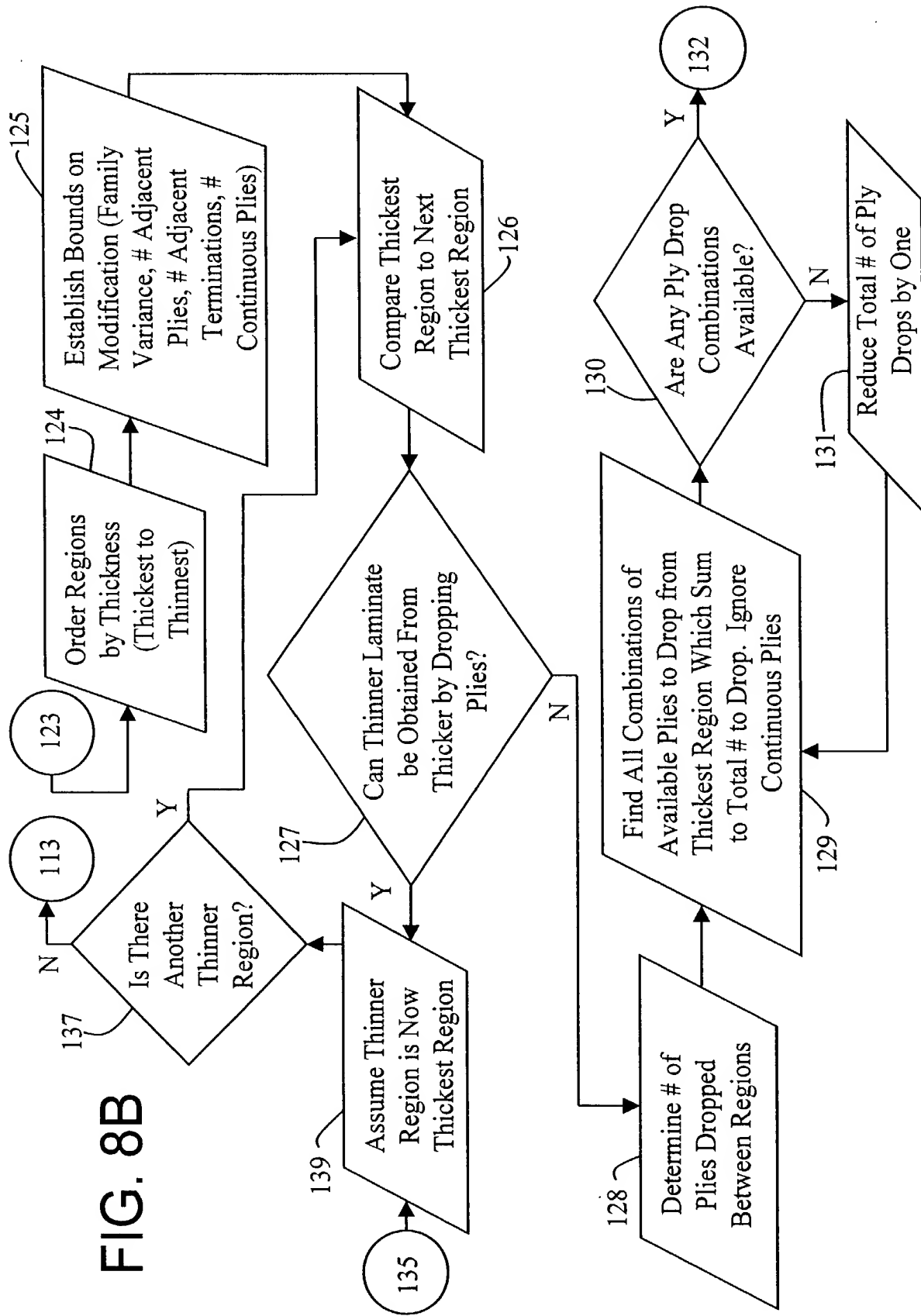
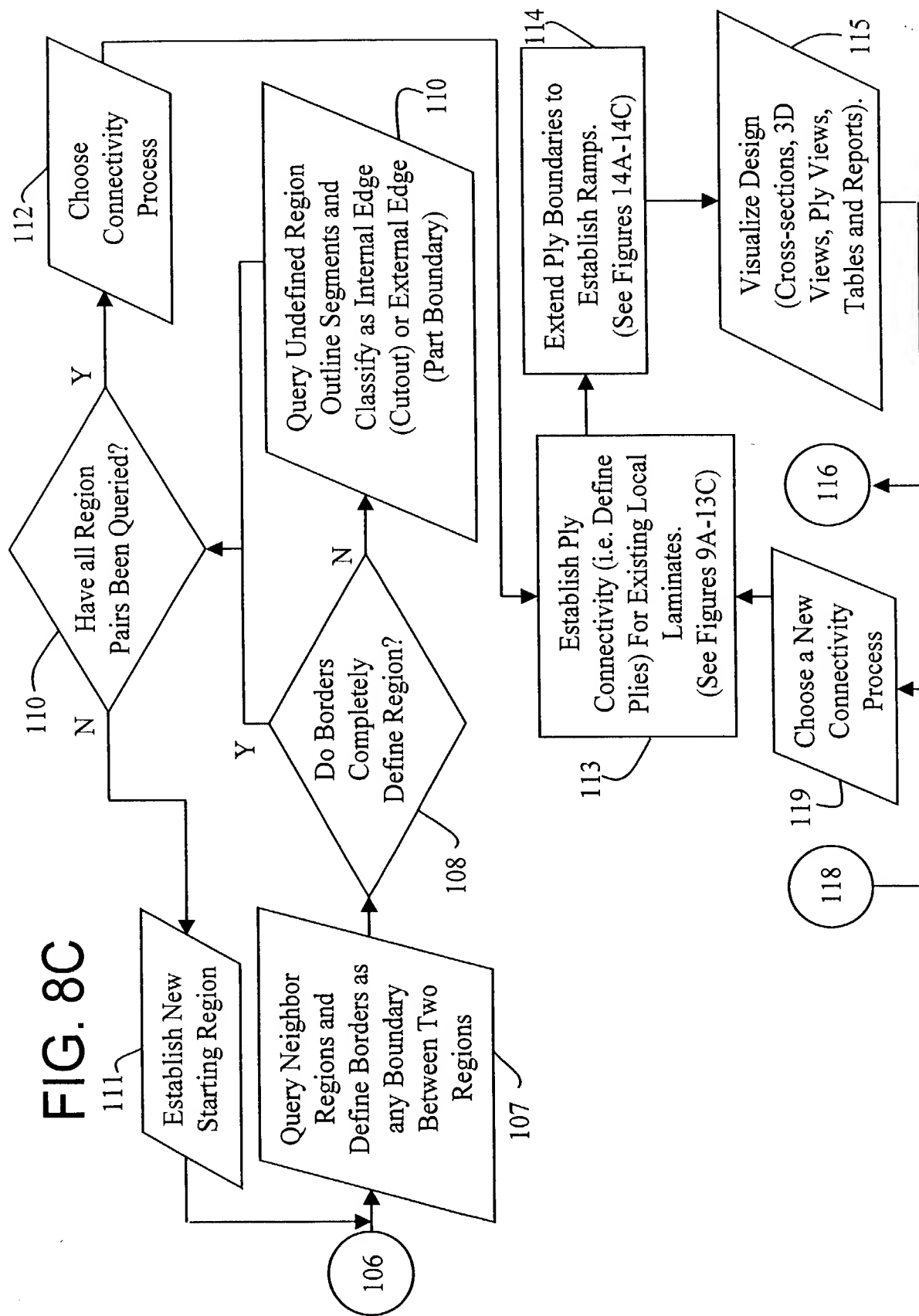


FIG. 8C



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FIG. 8D

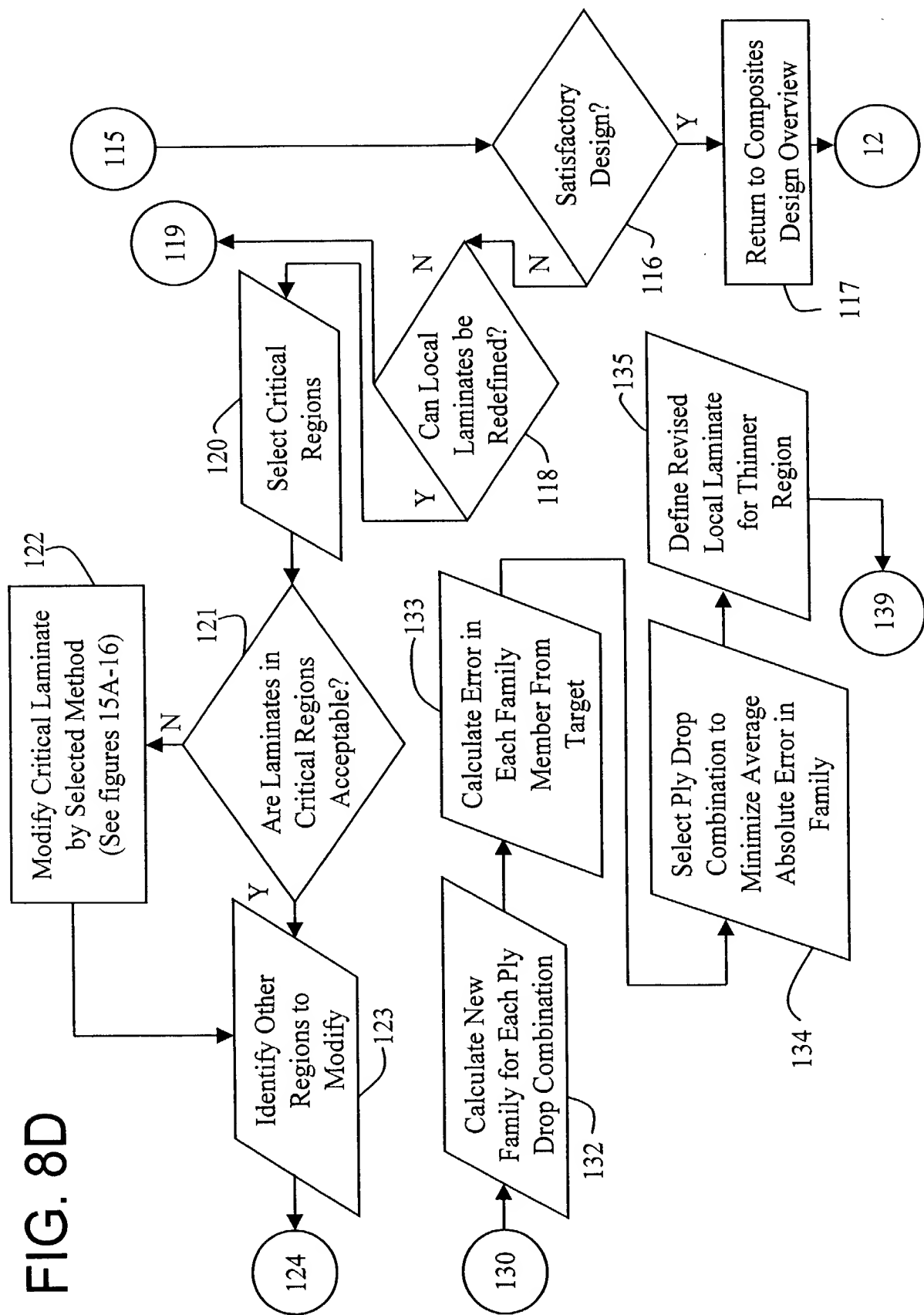
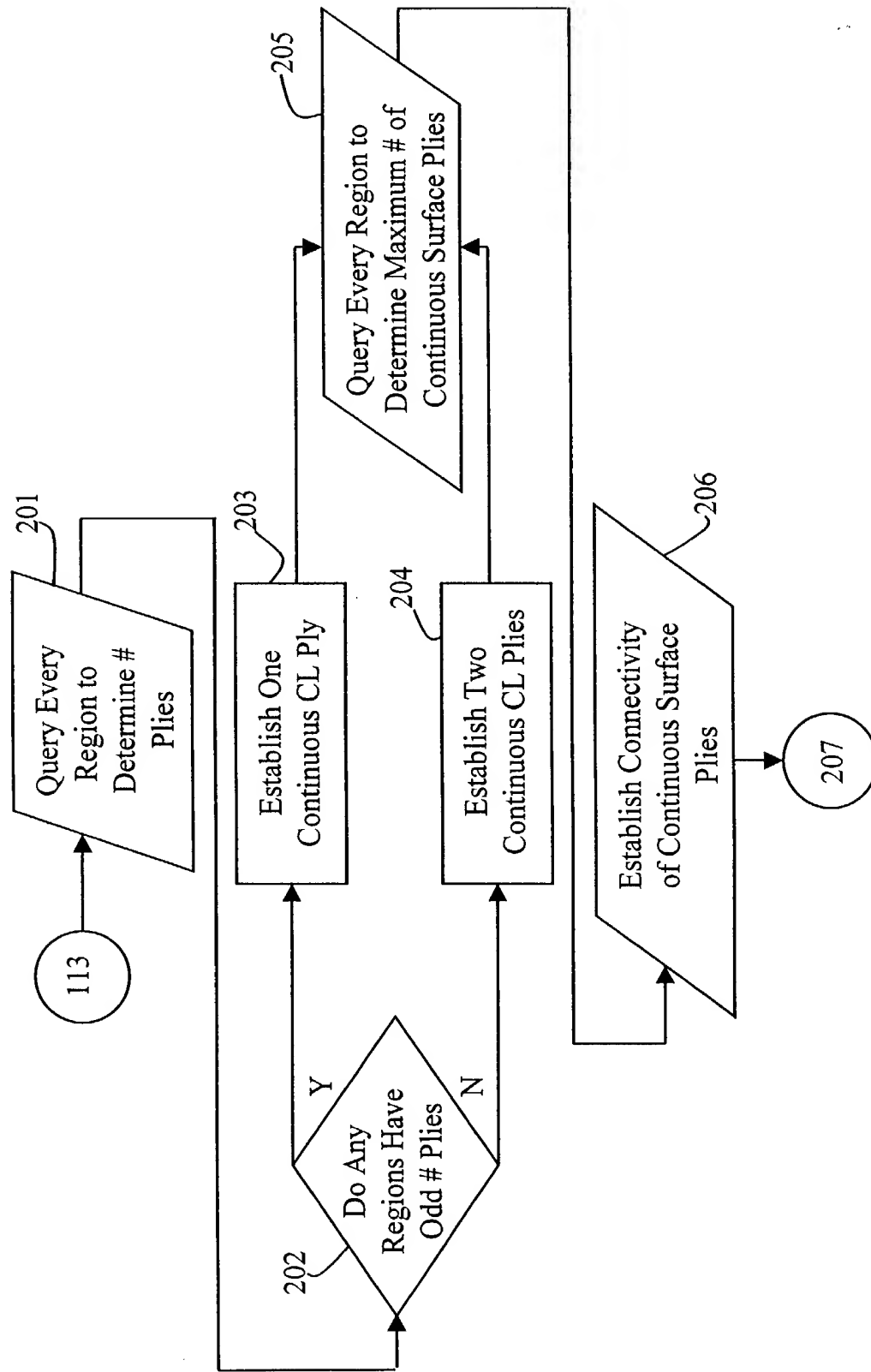


FIG. 9A



113 201 202 203 204 205 206 207

FIG. 9B

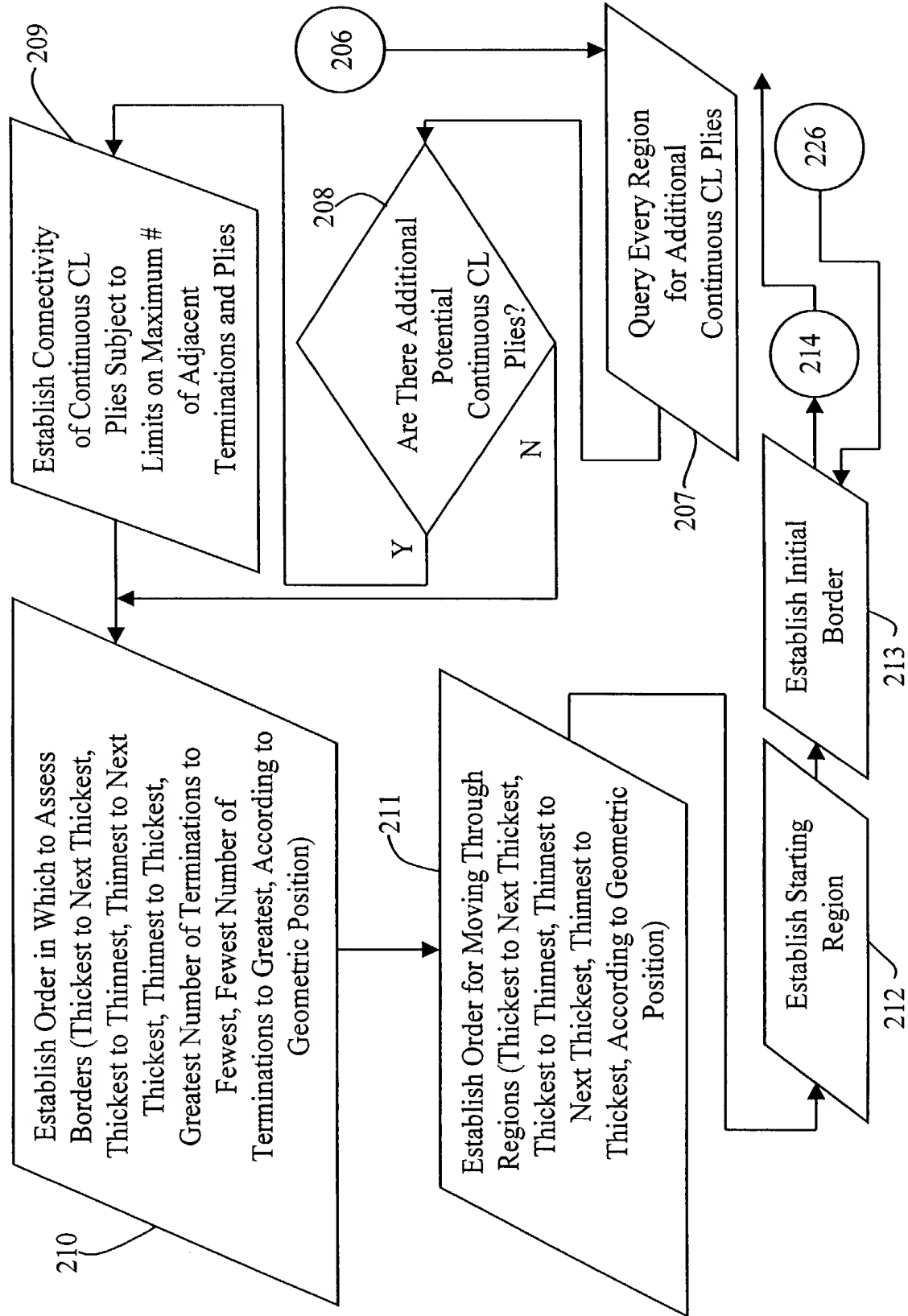


FIG. 9C

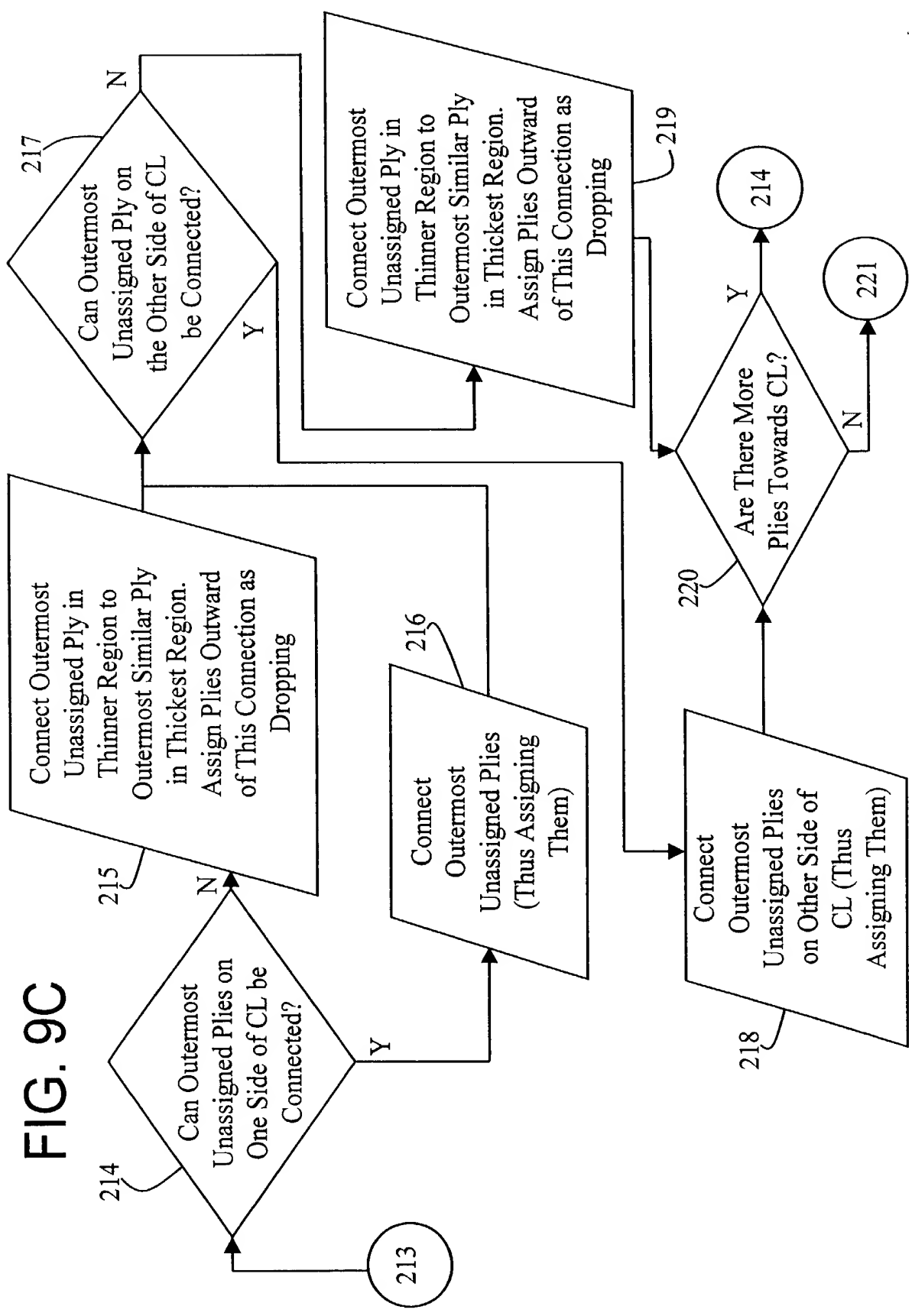


FIG. 9D

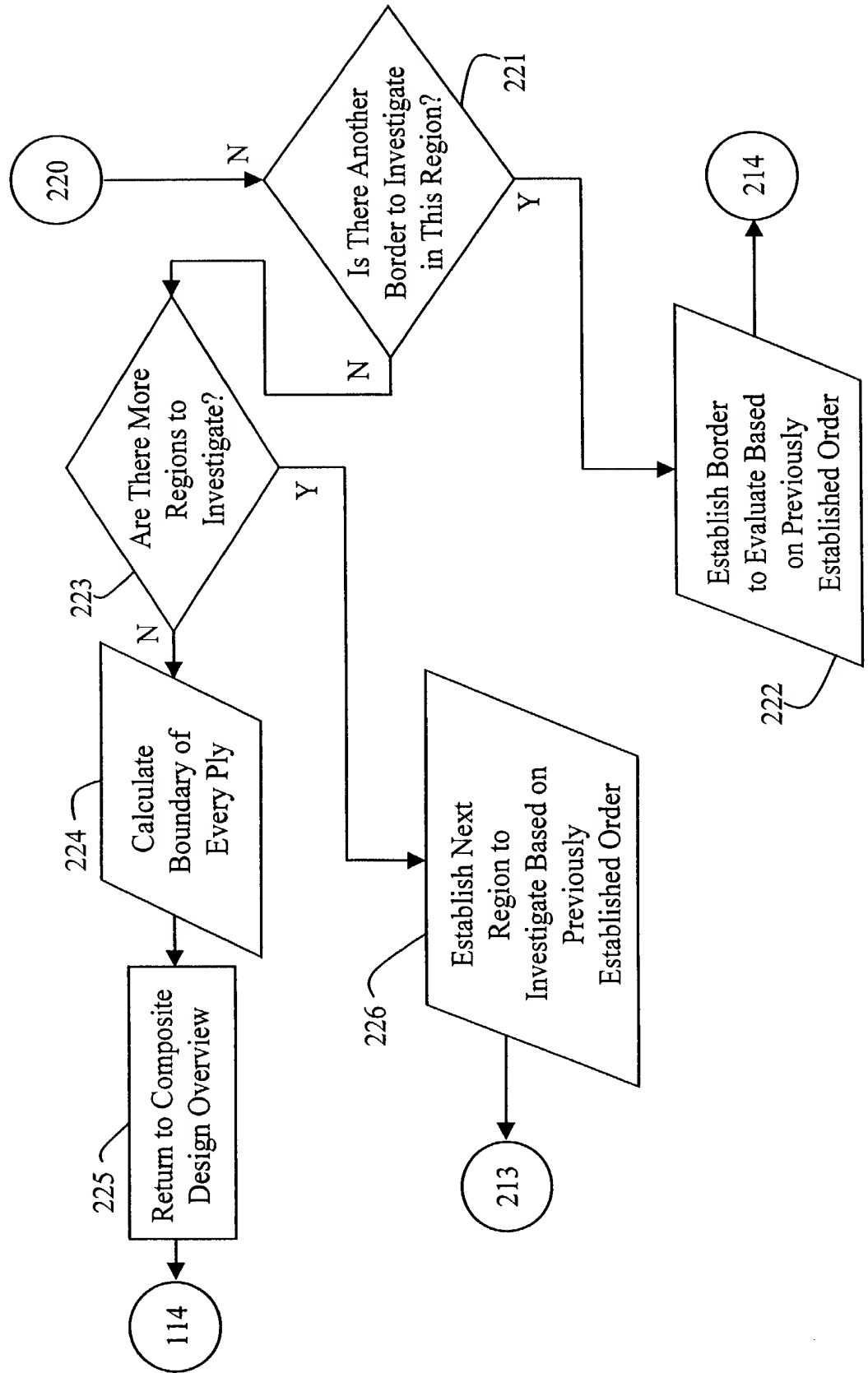
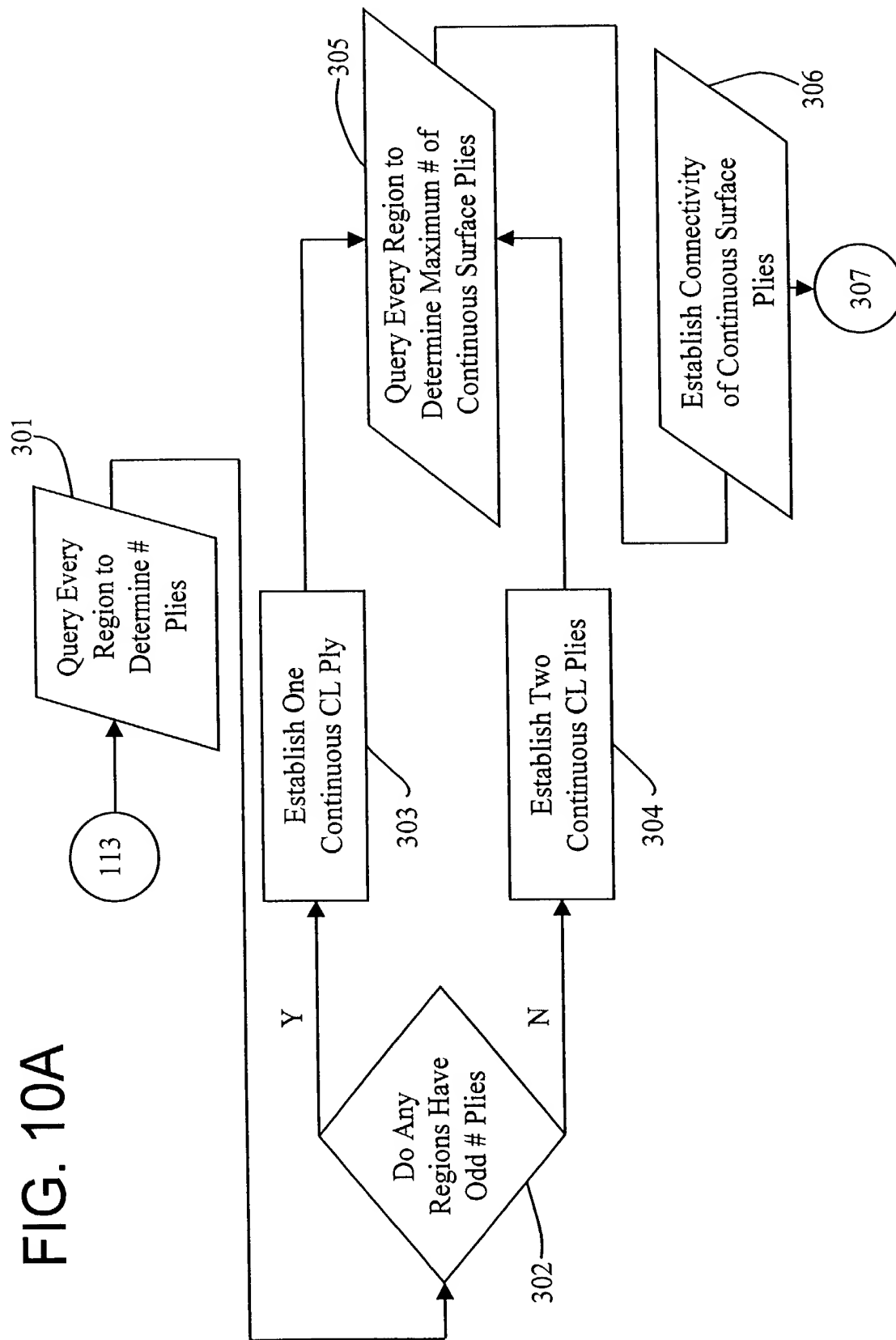


FIG. 10A



$$\left\{ \begin{matrix} x_1 & y_1 \\ x_2 & y_2 \\ \vdots & \vdots \\ x_n & y_n \end{matrix} \right\}, \quad \left\{ \begin{matrix} x_1 & y_1 \\ x_2 & y_2 \\ \vdots & \vdots \\ x_n & y_n \end{matrix} \right\}, \quad \left\{ \begin{matrix} x_1 & y_1 \\ x_2 & y_2 \\ \vdots & \vdots \\ x_n & y_n \end{matrix} \right\}, \quad \left\{ \begin{matrix} x_1 & y_1 \\ x_2 & y_2 \\ \vdots & \vdots \\ x_n & y_n \end{matrix} \right\}, \quad \left\{ \begin{matrix} x_1 & y_1 \\ x_2 & y_2 \\ \vdots & \vdots \\ x_n & y_n \end{matrix} \right\},$$


FIG. 10C

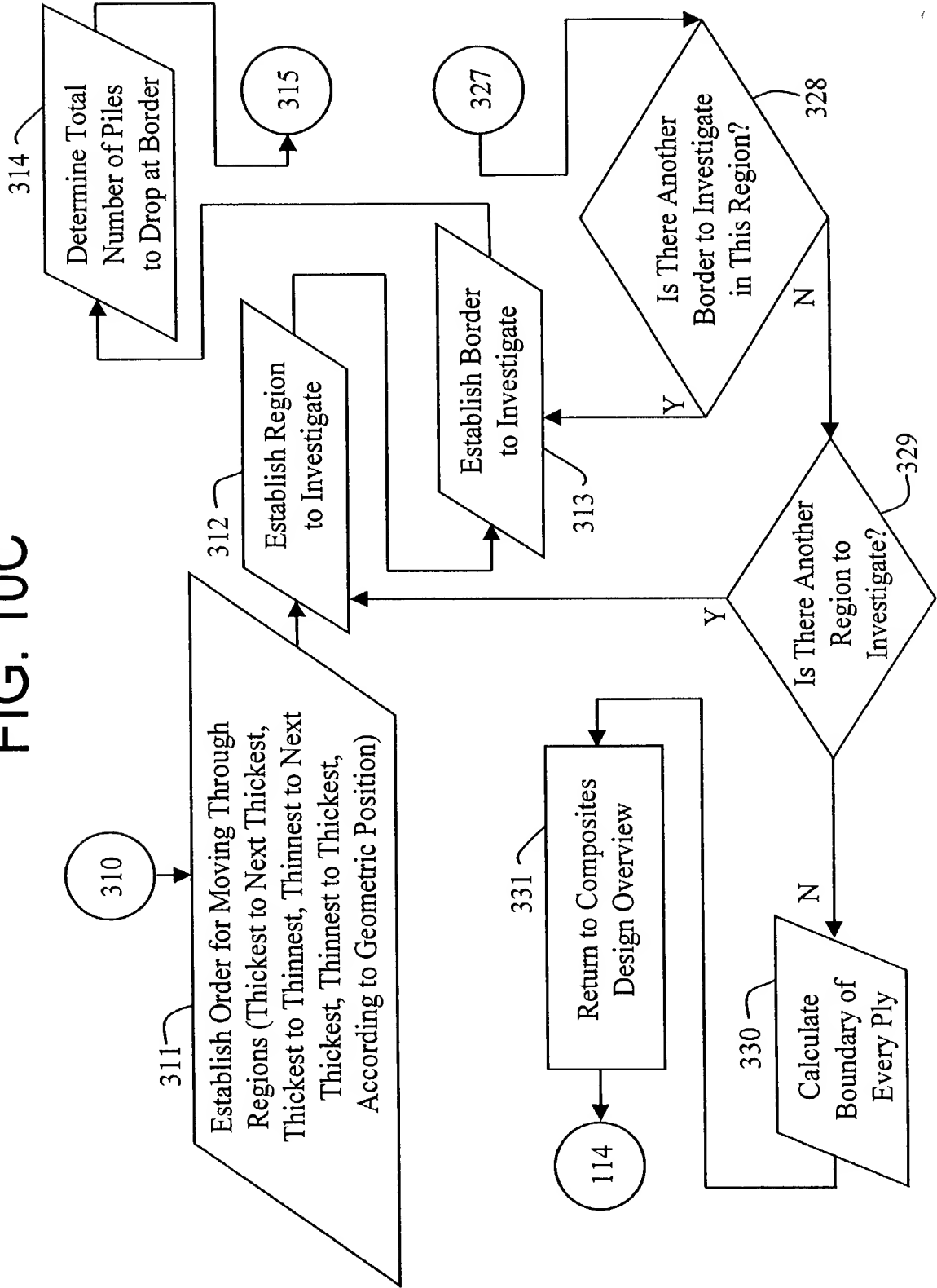


FIG. 10D

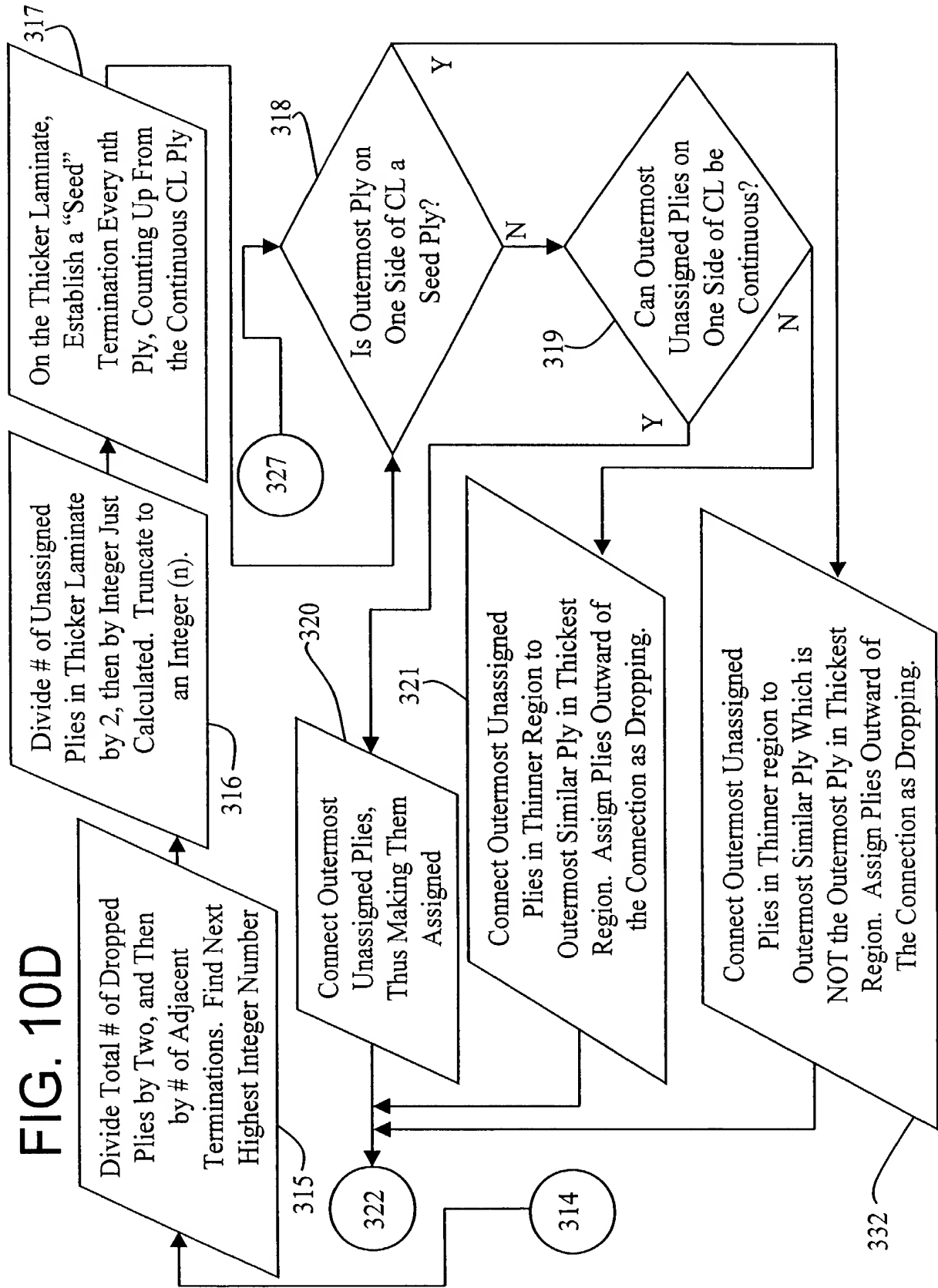


FIG. 10E

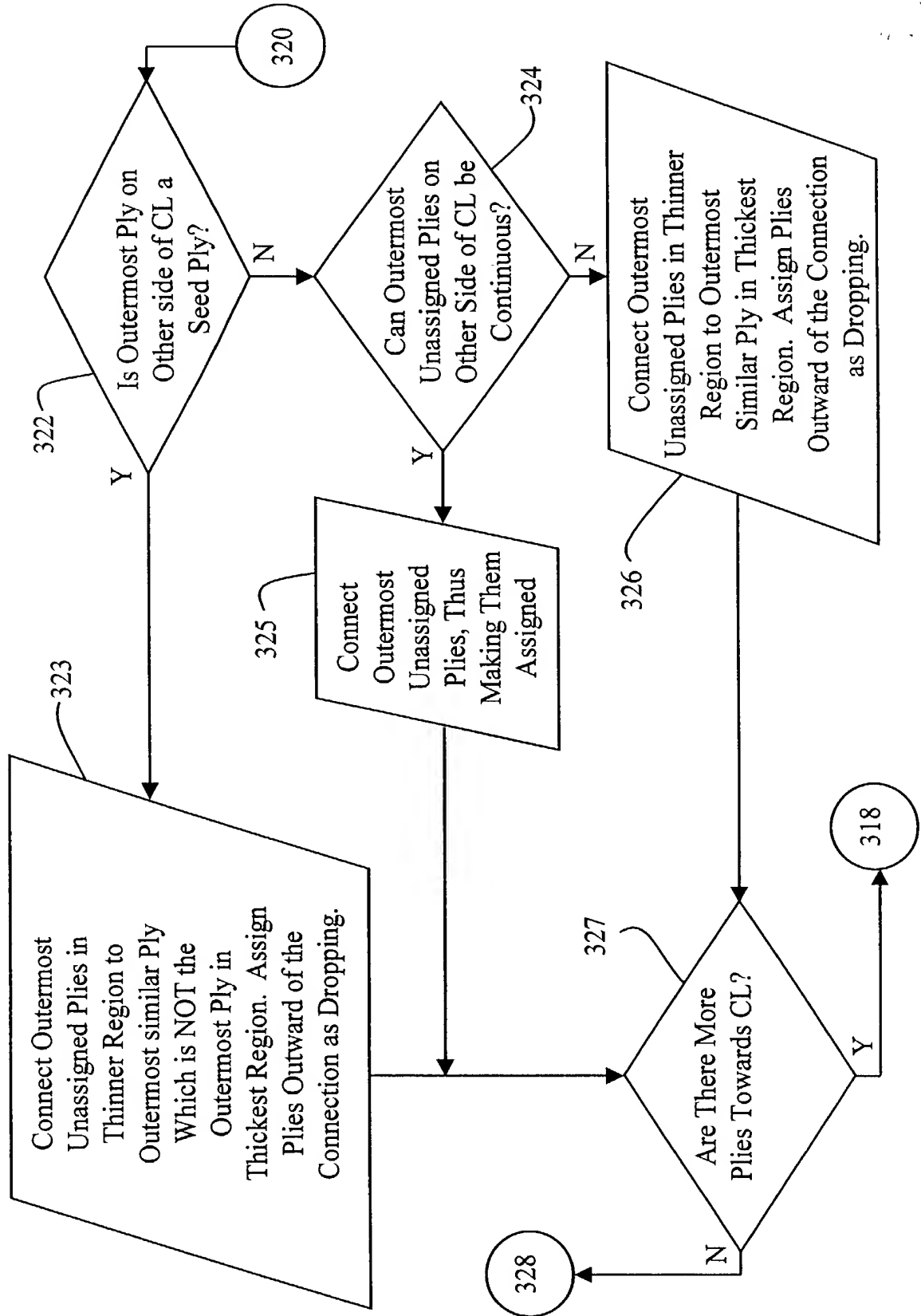


FIG. 11A

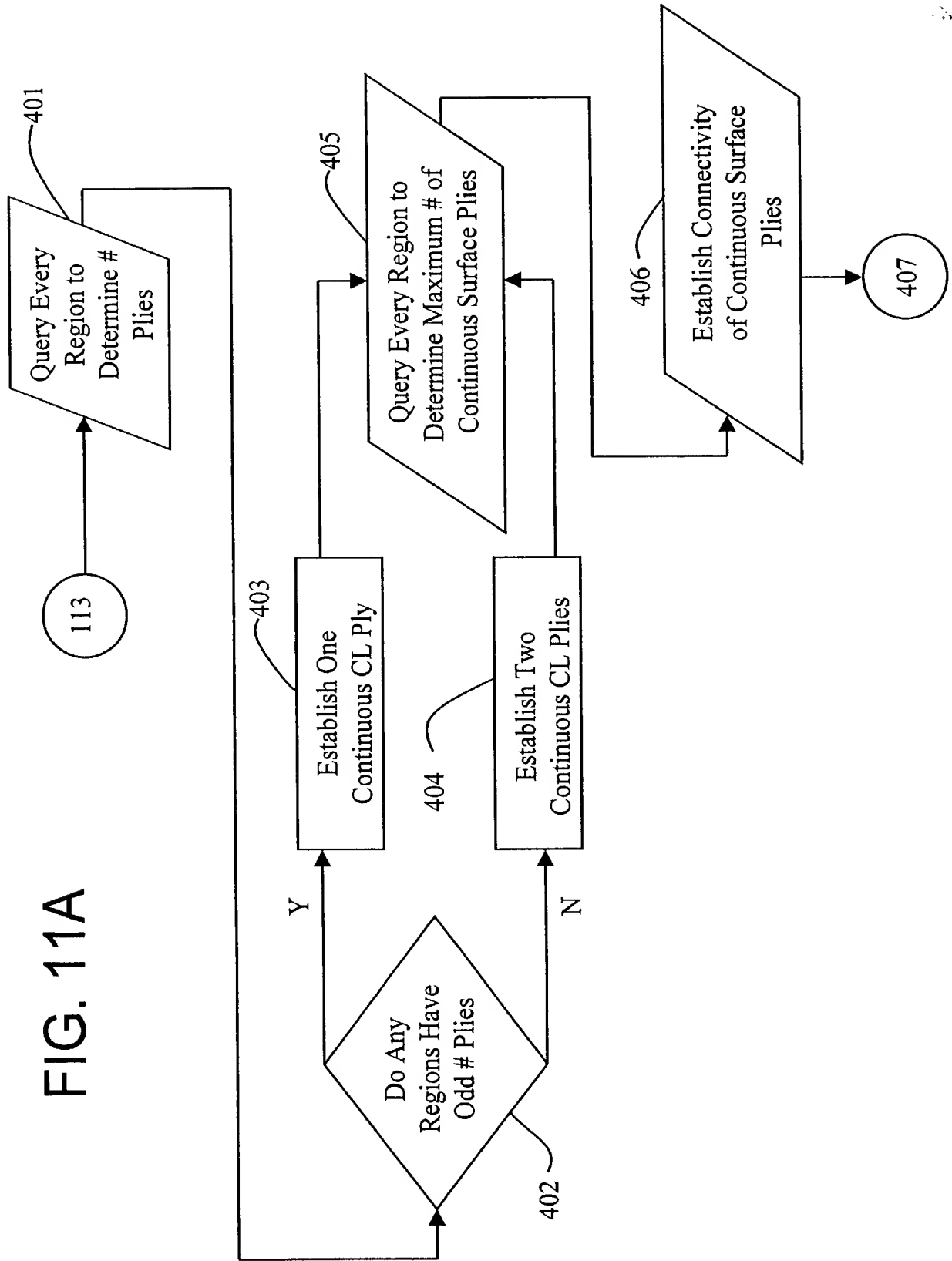


FIG. 11B

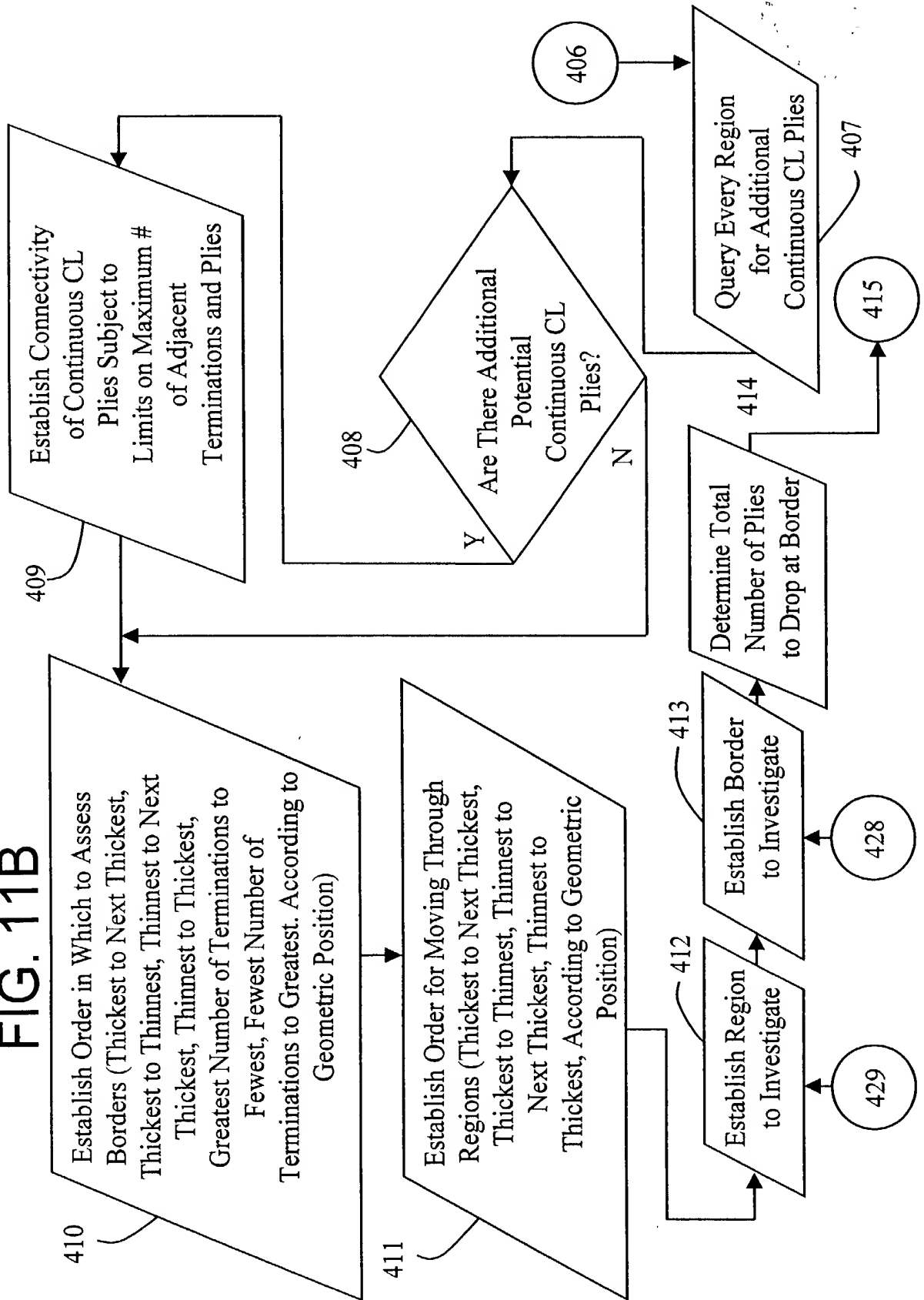


FIG. 11D

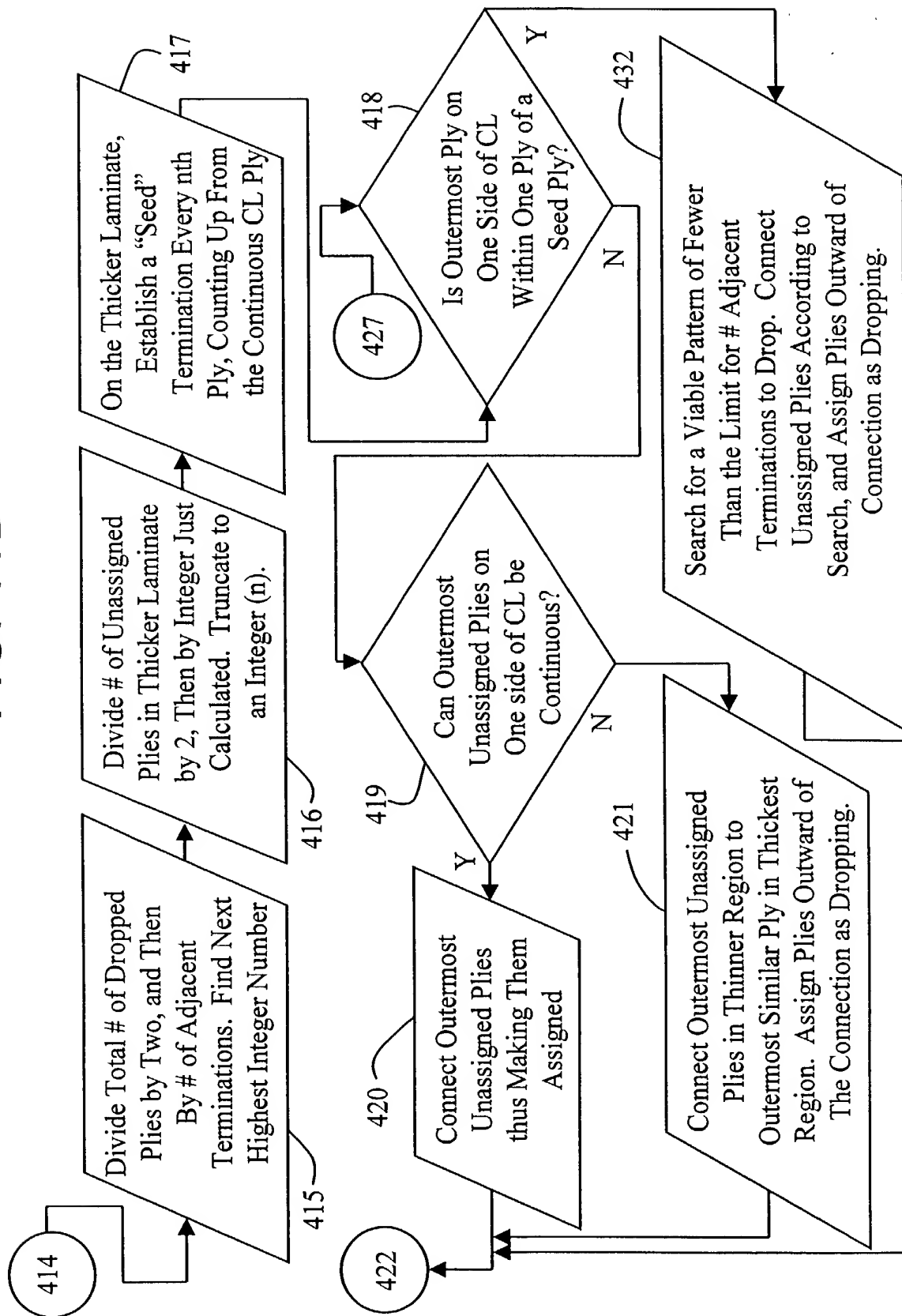
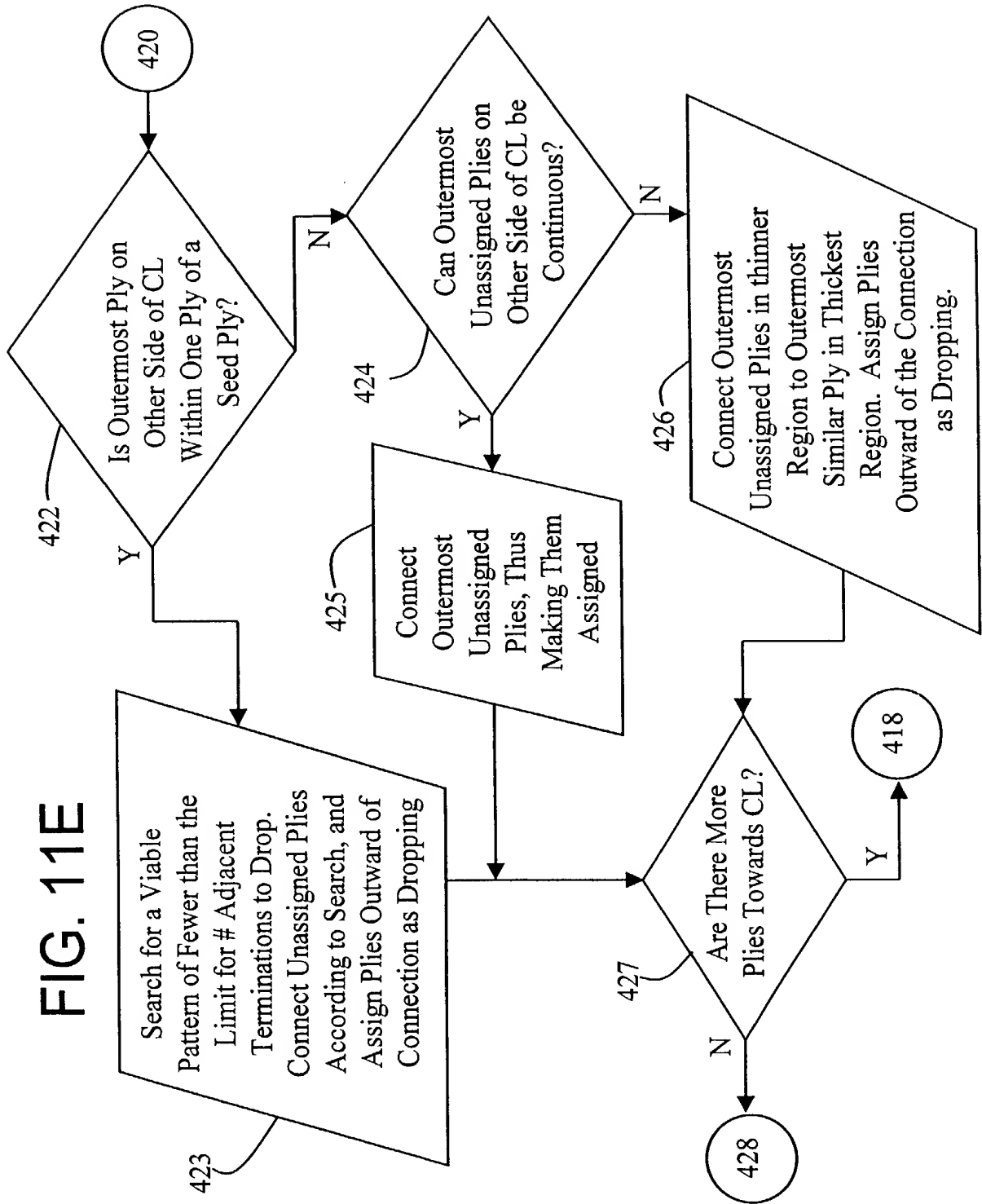


FIG. 11E



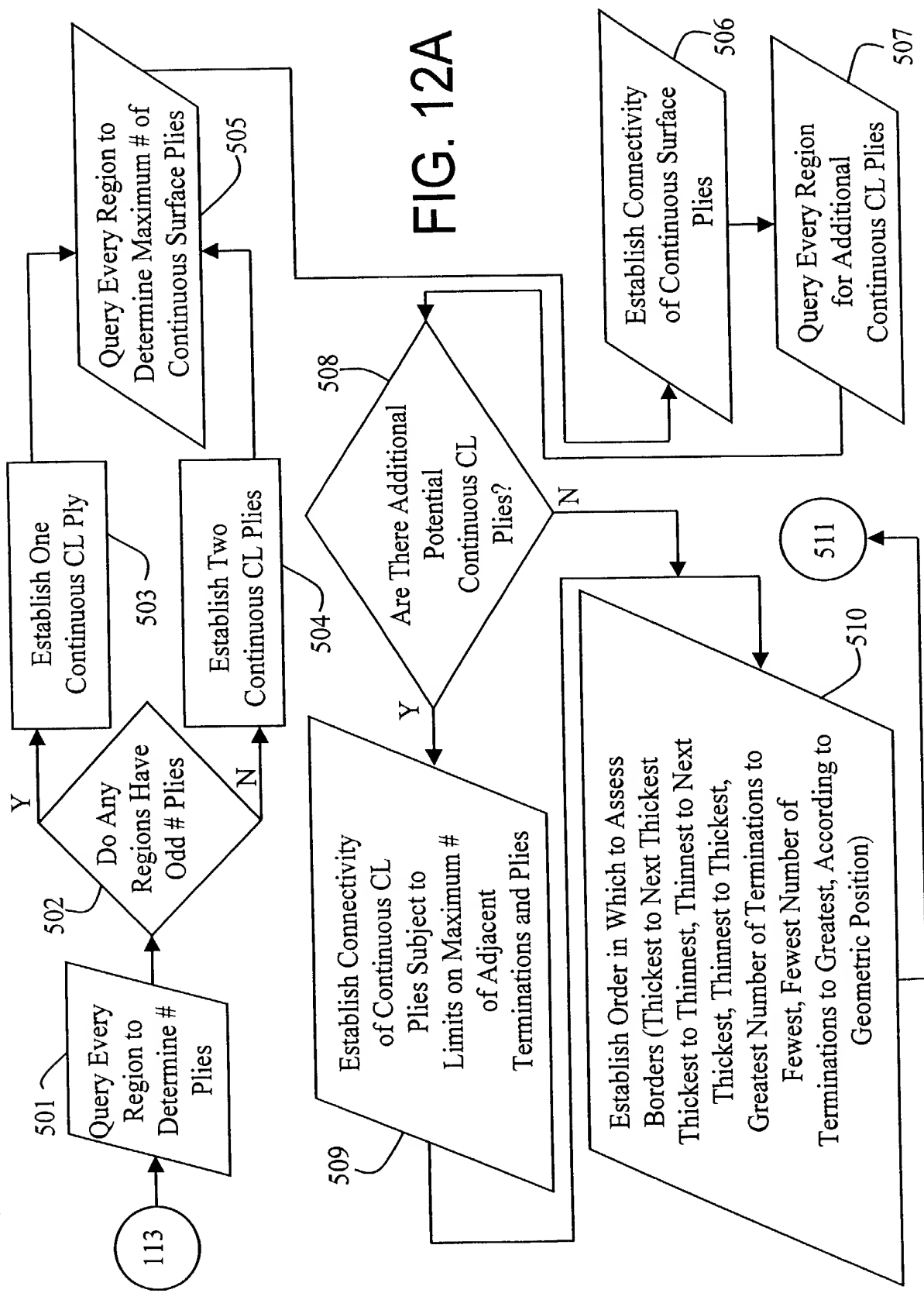


FIG. 12A

FIG. 12B

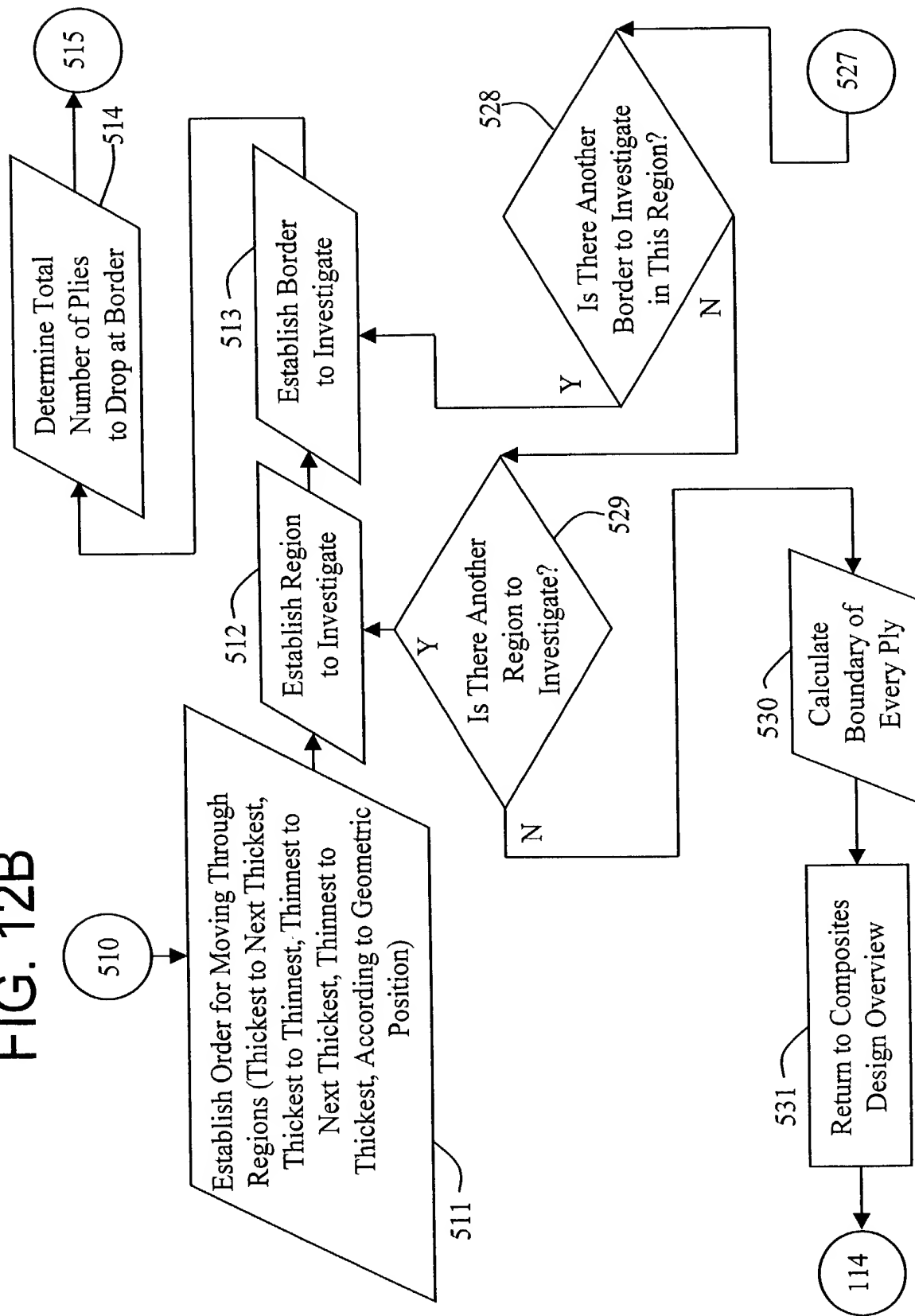


FIG. 12C

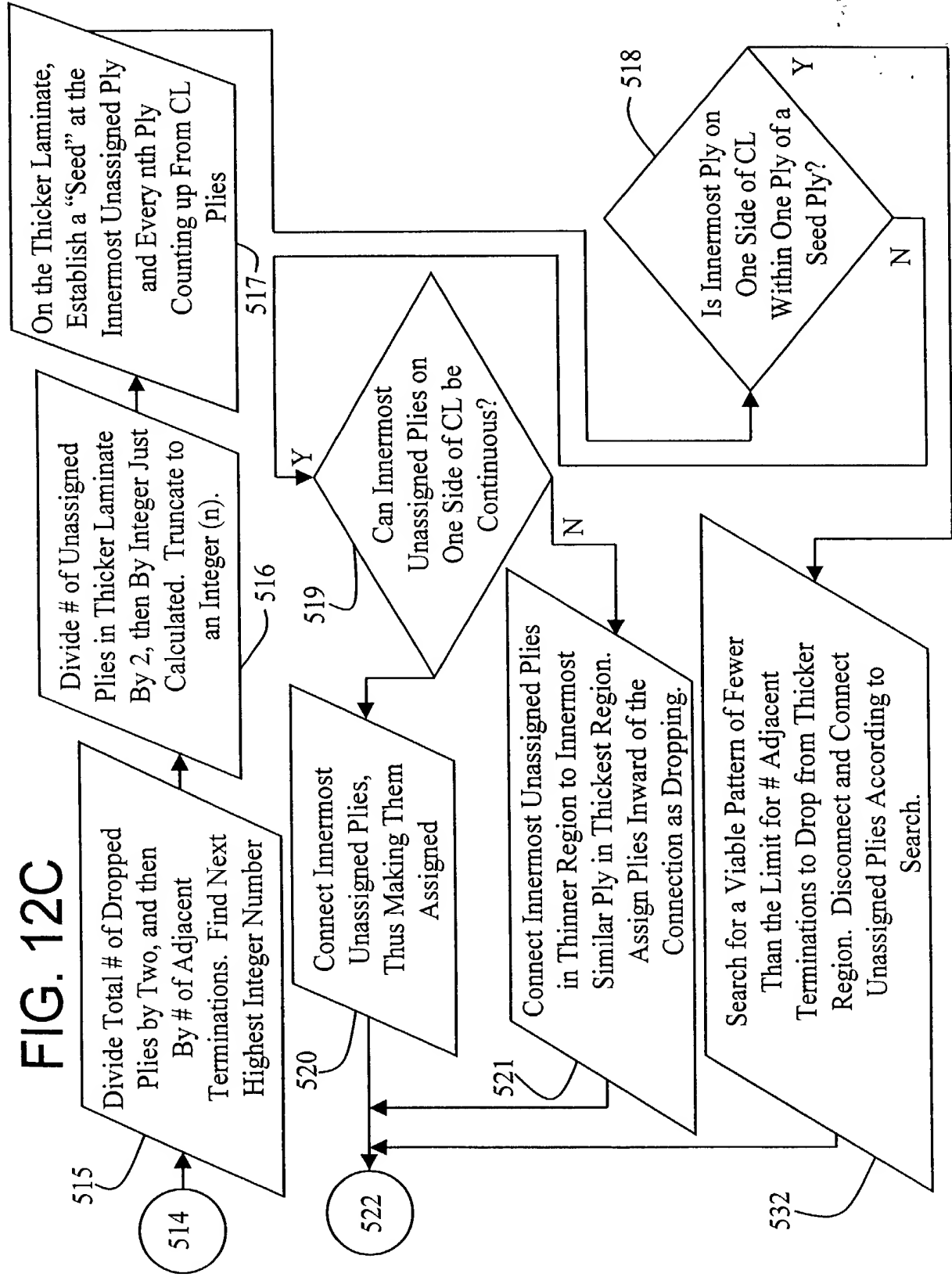


FIG. 12D

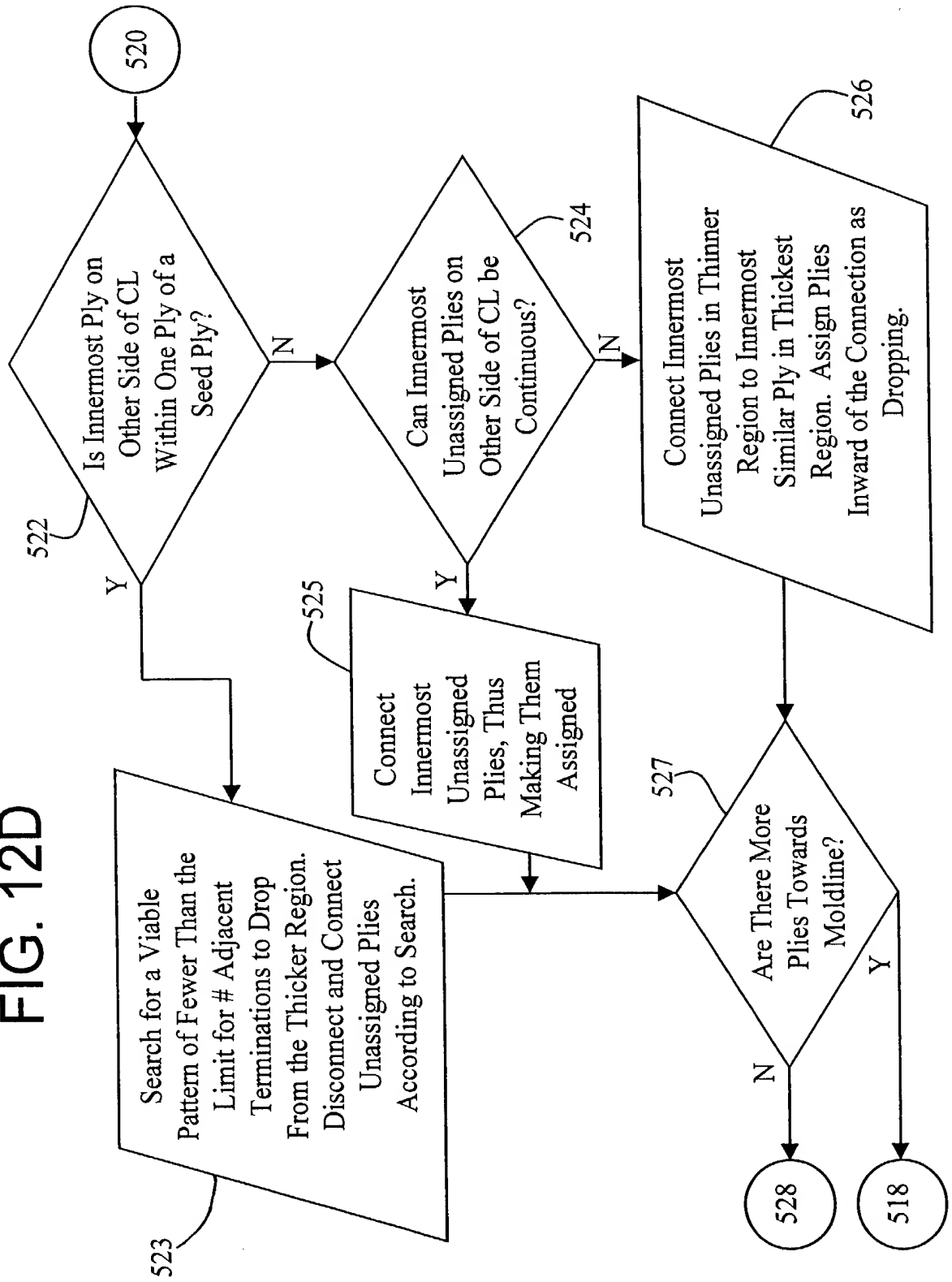


FIG. 13C

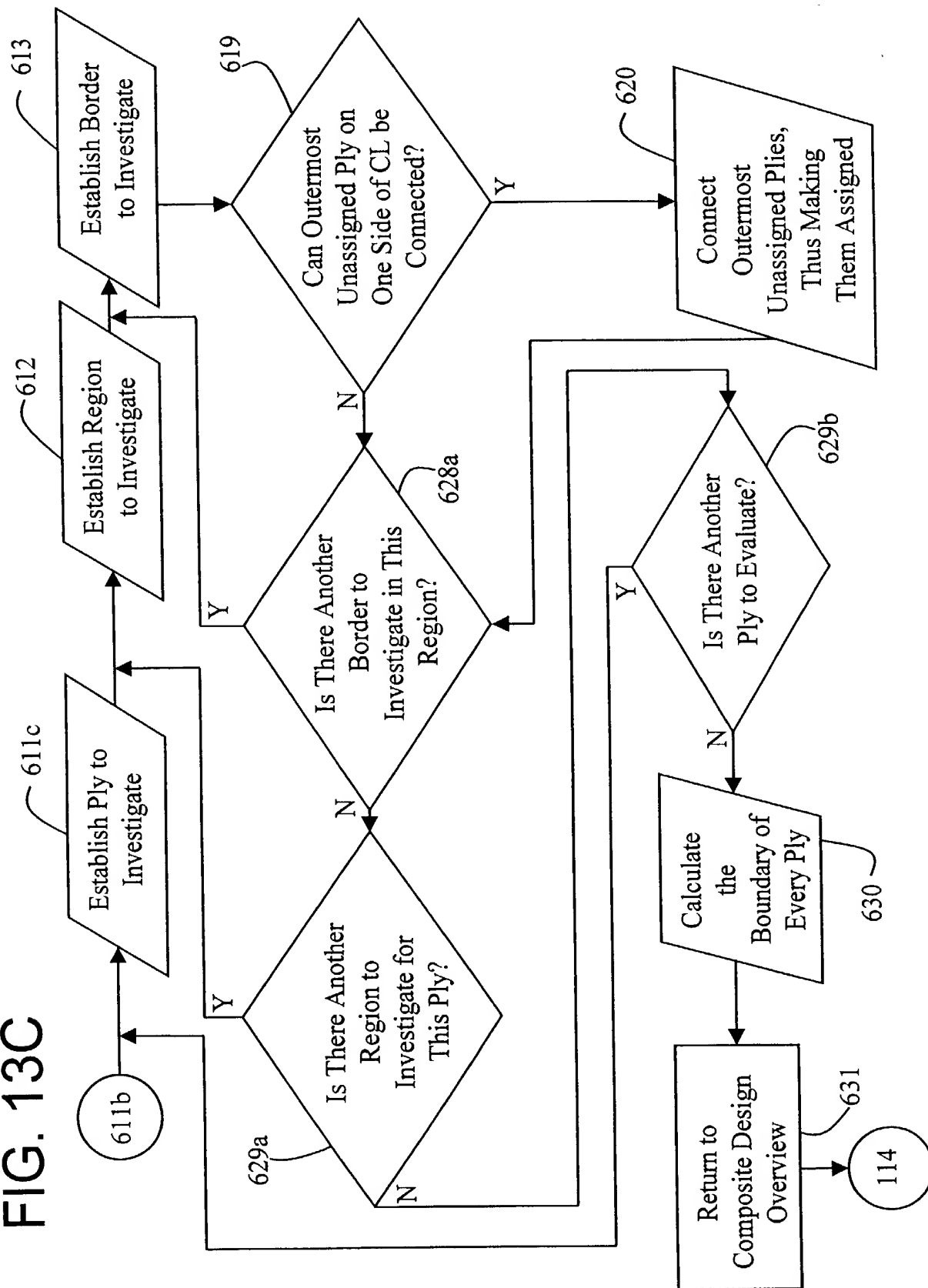


FIG. 13B

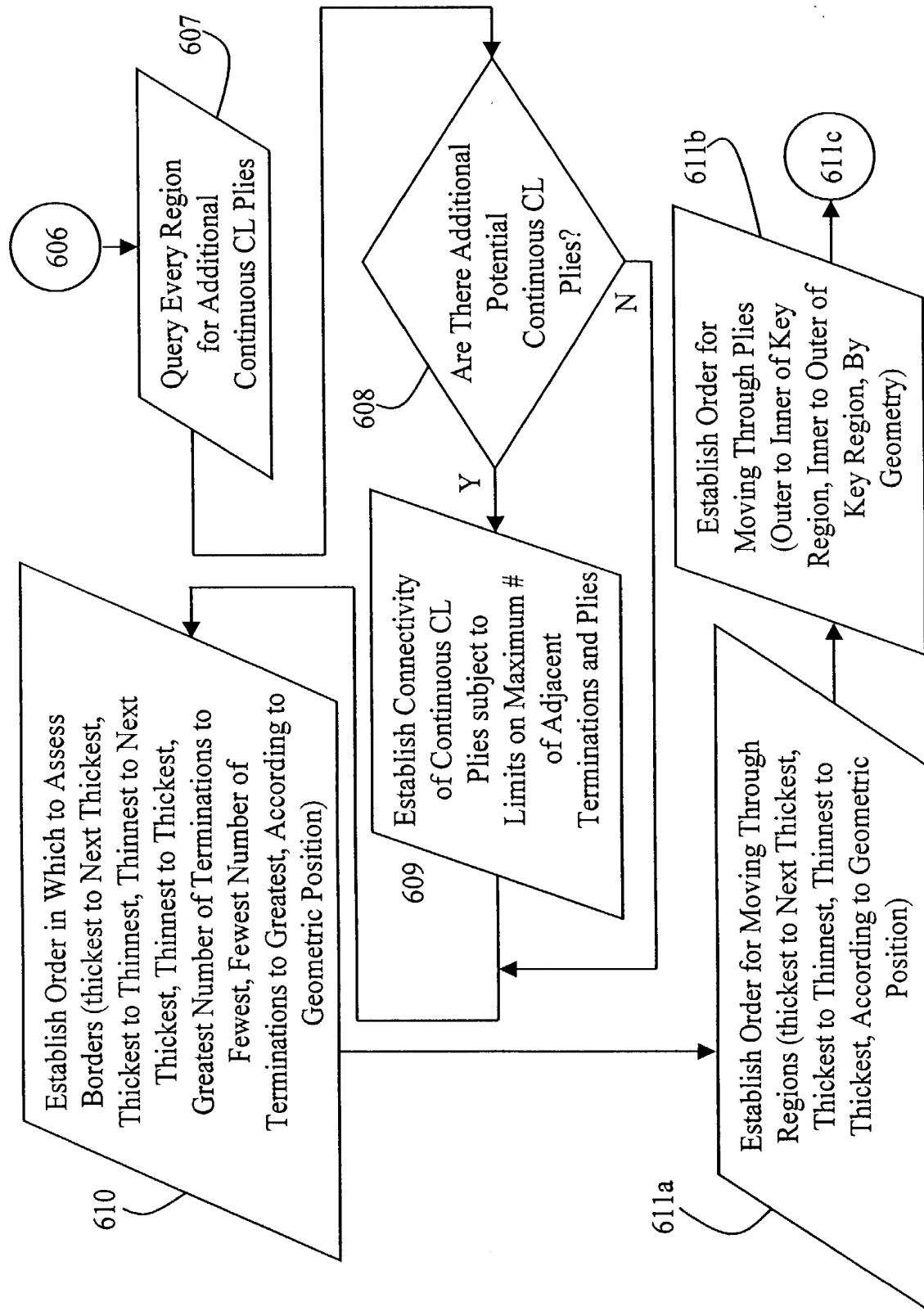


FIG. 14A

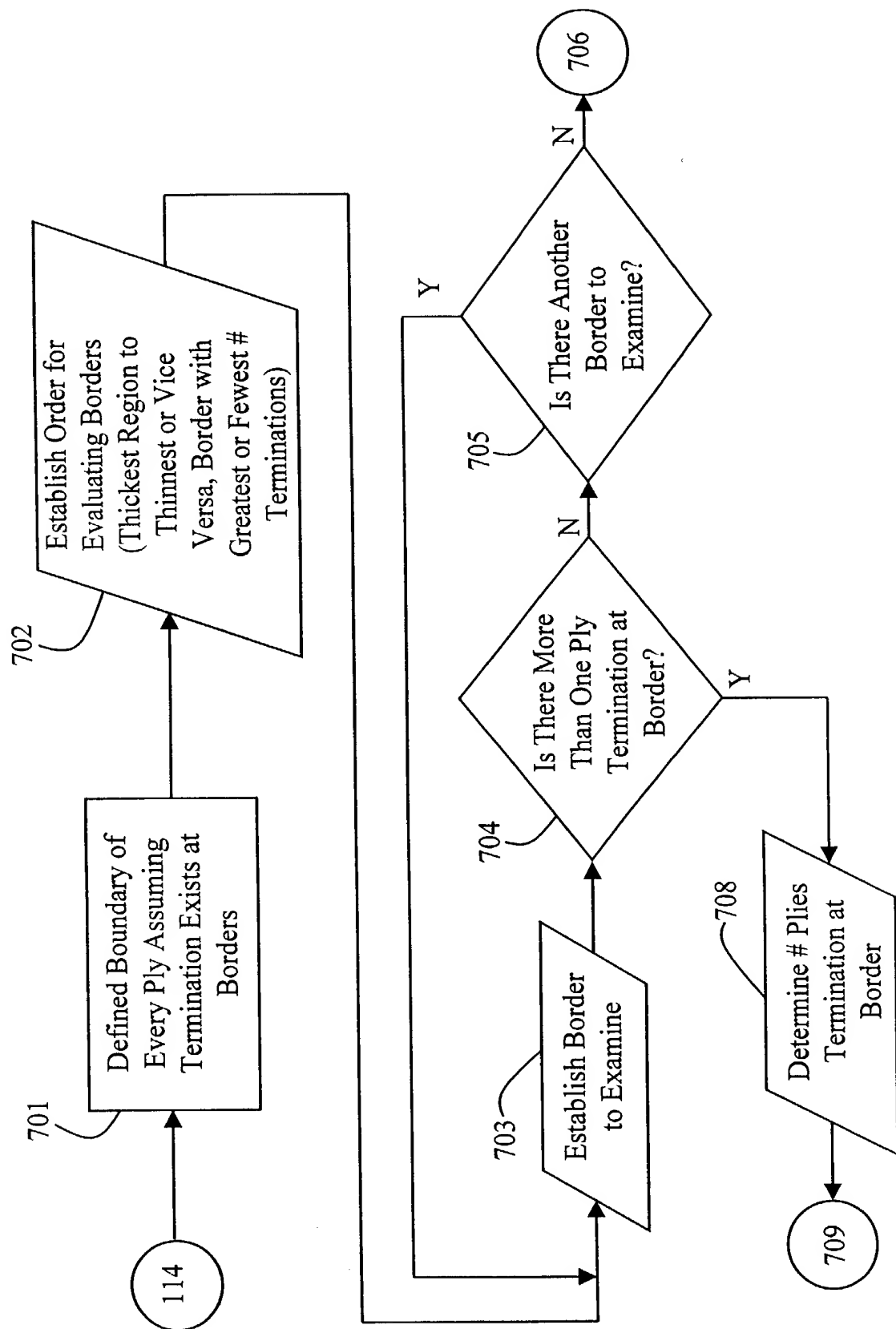


FIG. 14B

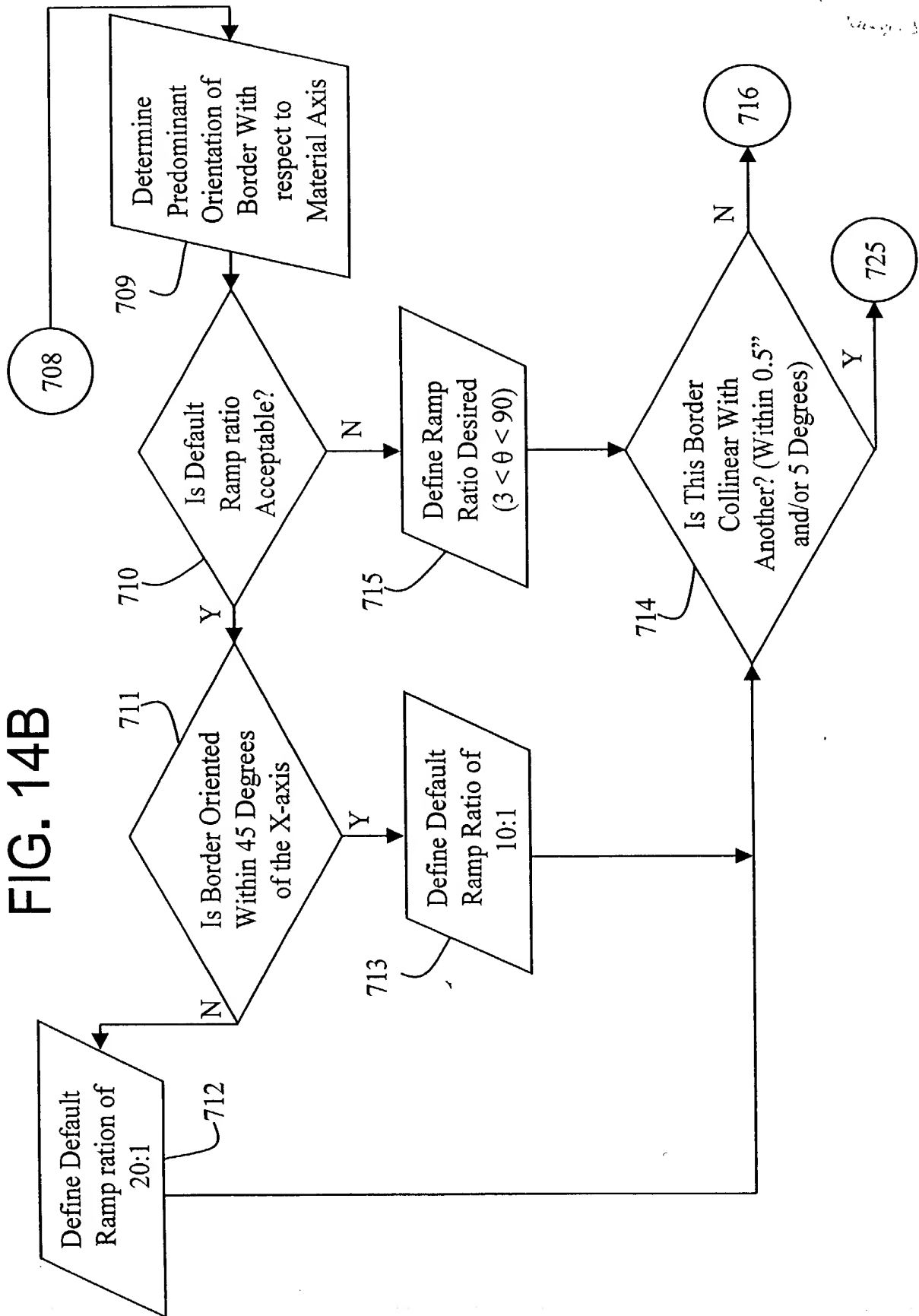


FIG. 14C

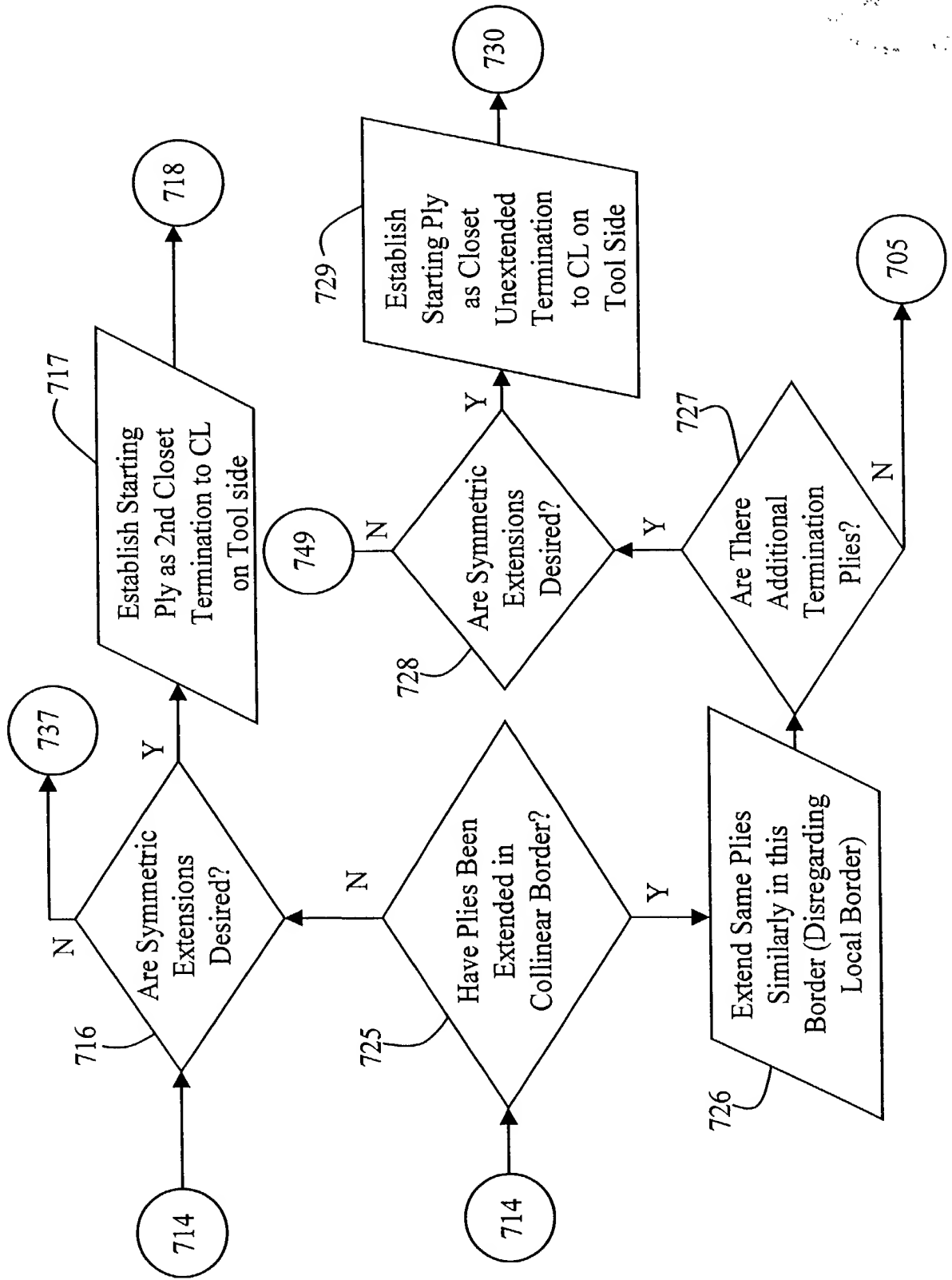


FIG.14D

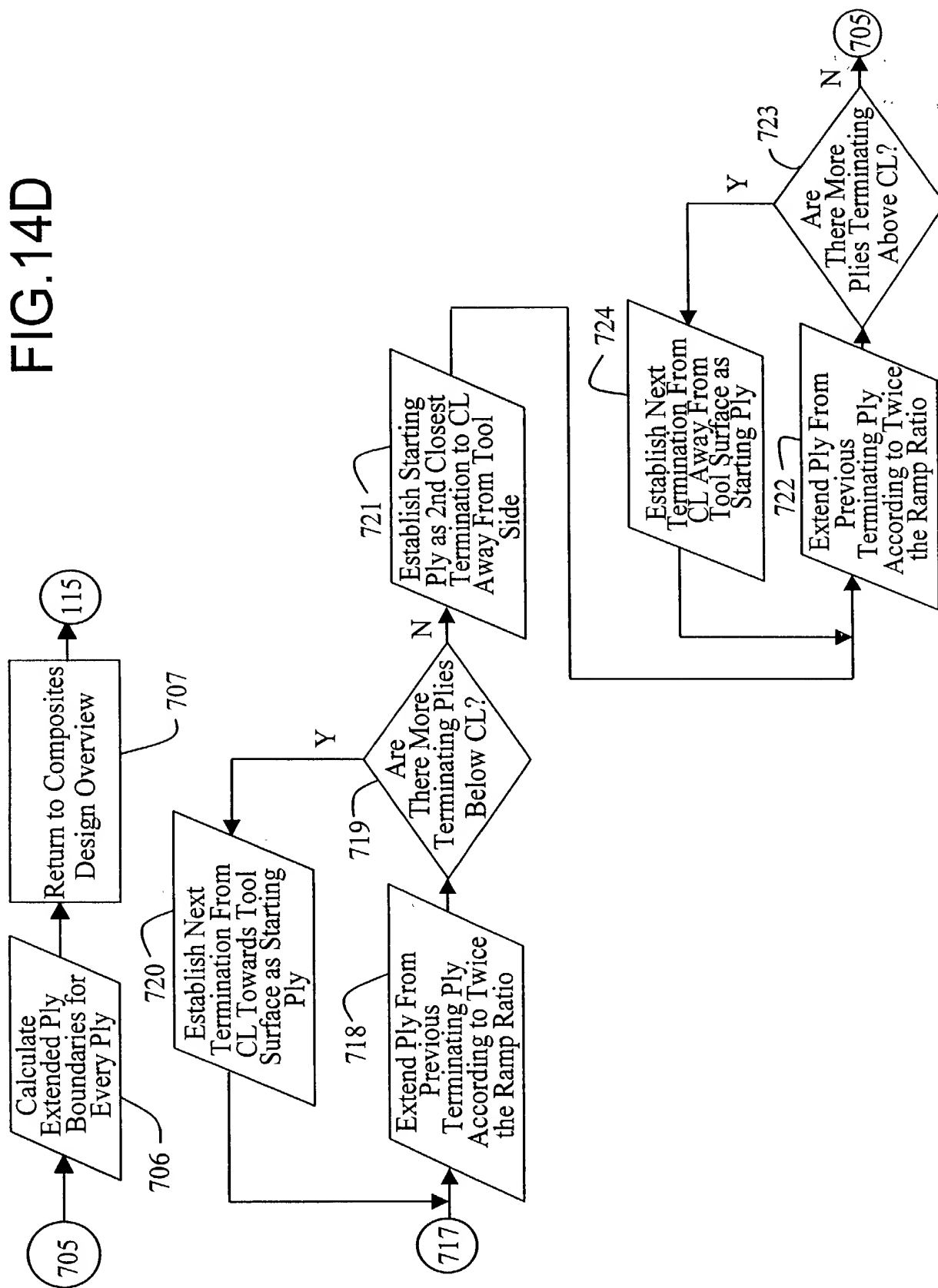


FIG. 14E

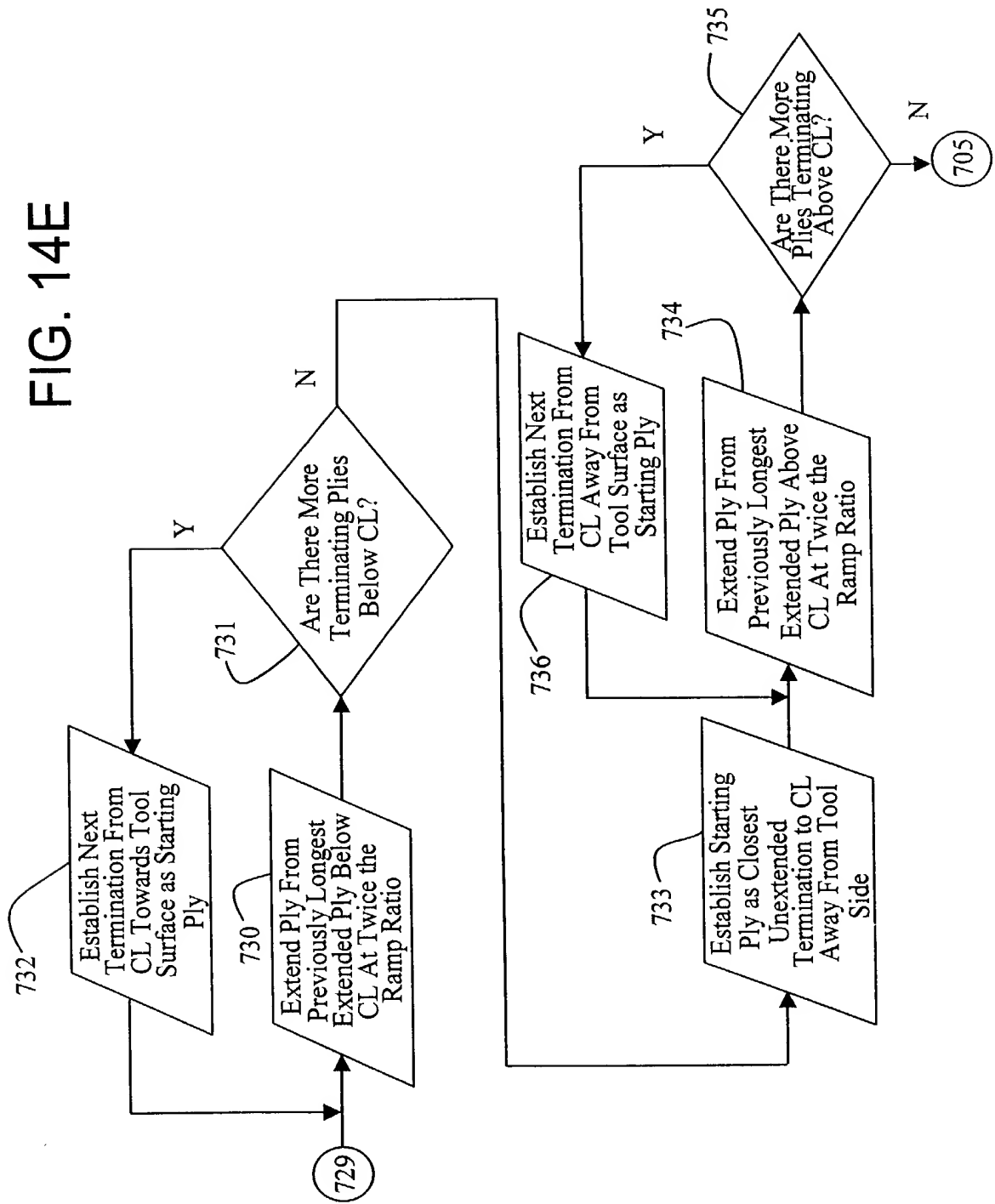


FIG. 14G

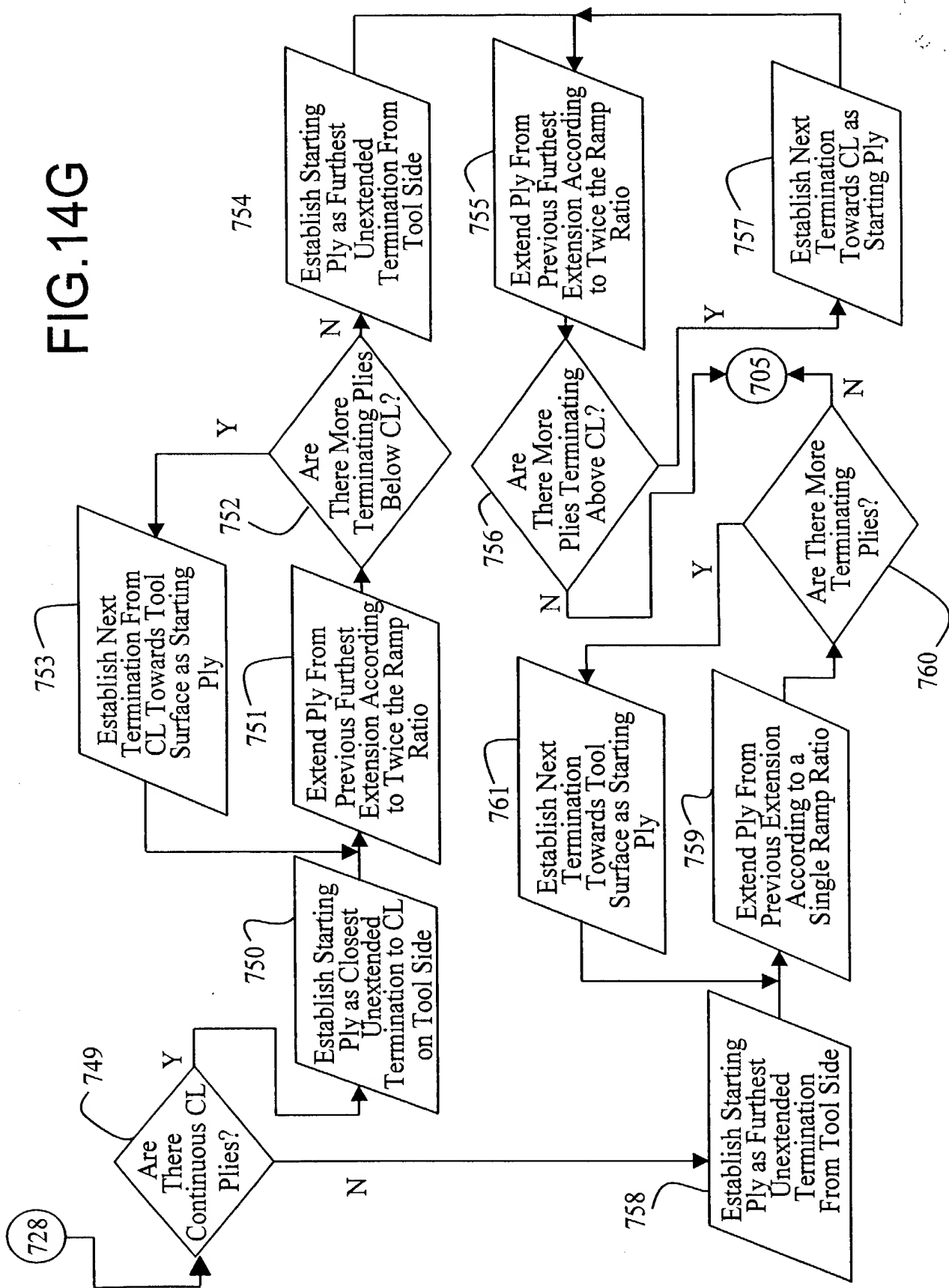


FIG. 15A

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User Inputs: Name of saved output file, Laminate thickness, Maximum allowed thickness, Ply thickness, Number of materials, Material properties (stiffness, poisson's ratio, thermal expansion coefficients, stress and strain allowables), Laminate family, Allowed variation in family, Extreme bounds on family, Number of similar adjacent plies allowed, Surface cloth material desired for moldline panels, Loading options, Failure criteria (Max. stress, max. strain, Tsai-Hill, Bearing-Bypass), Number of load cases, Load angle with respect to material axis, In-plane loads and moments, Pressure on panel, Panel Geometry, Data reduction flags (number of desired solutions based on strength or stiffness requirements -- for strength the most positive safety margin, the least positive safety margin and a defined number of intermediate solutions; for stiffness the most and least stiff and a defined number of intermediate solutions for each primary stiffness).

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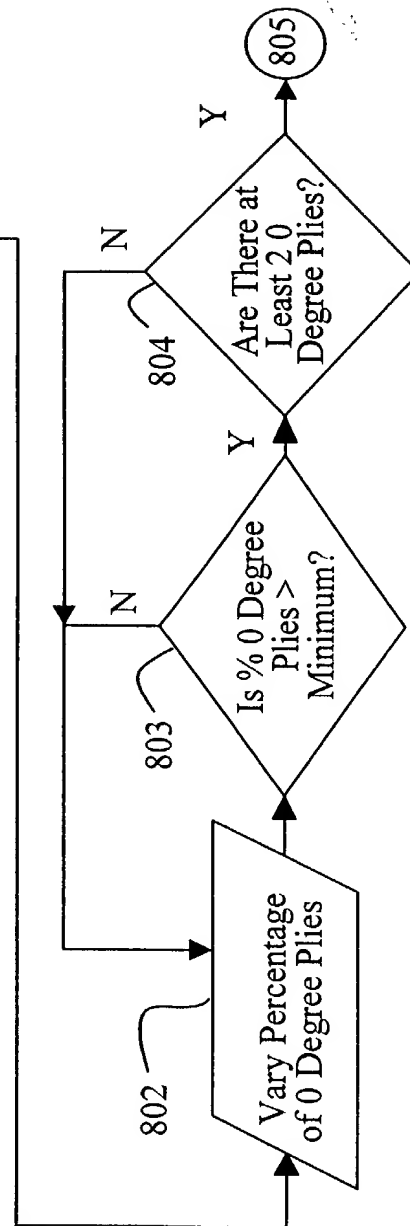


FIG. 15B

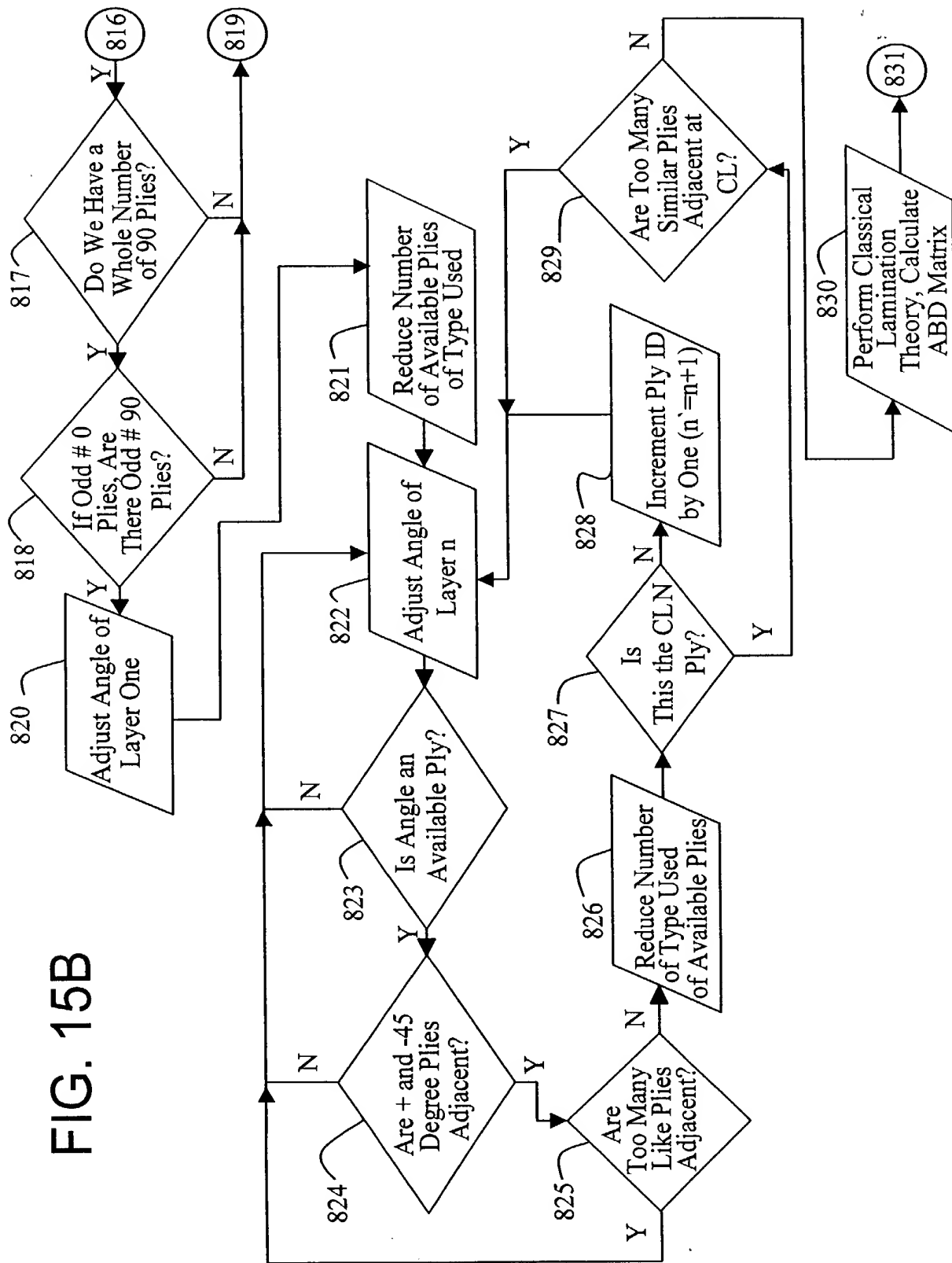


FIG. 15C

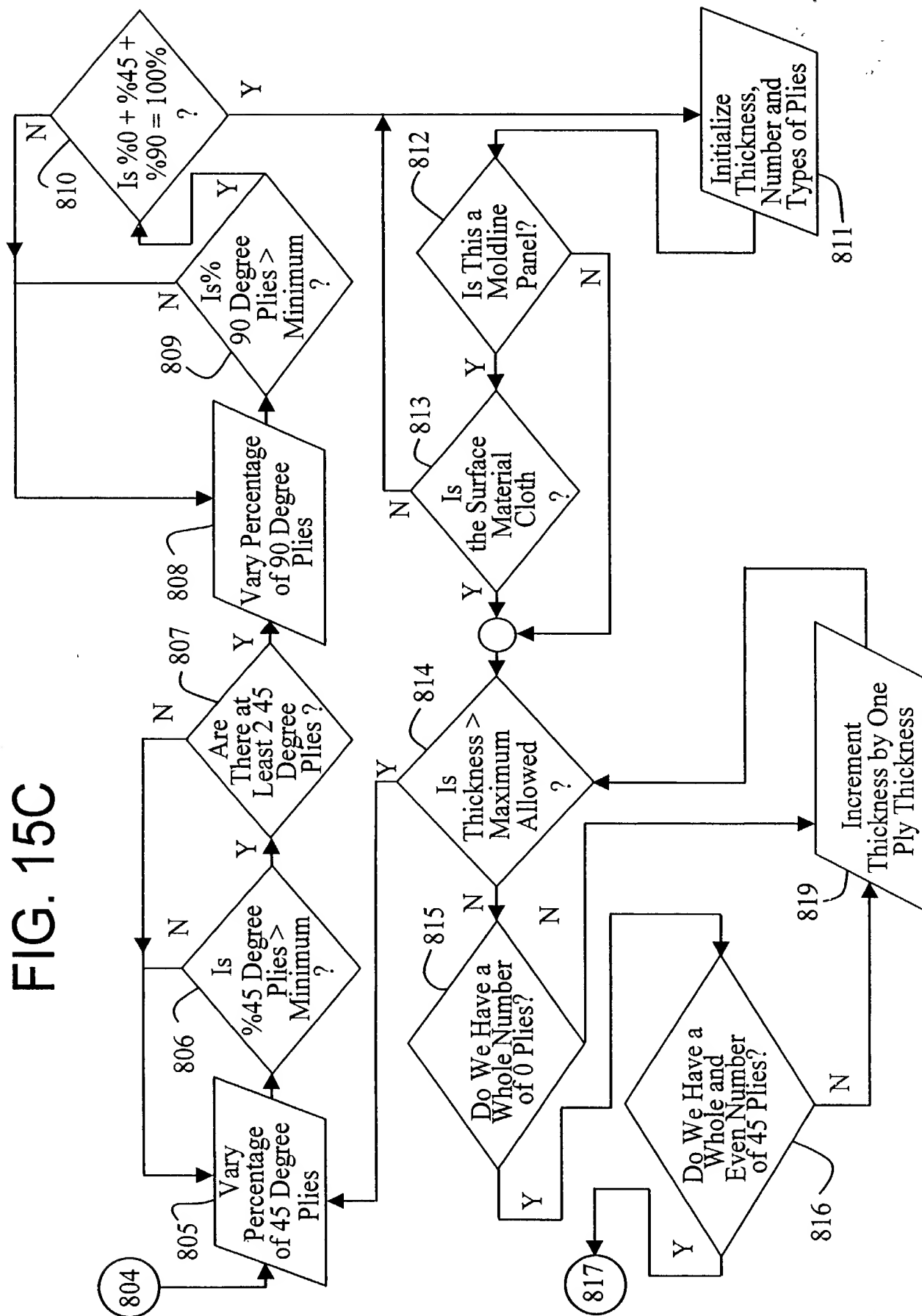


FIG. 15D

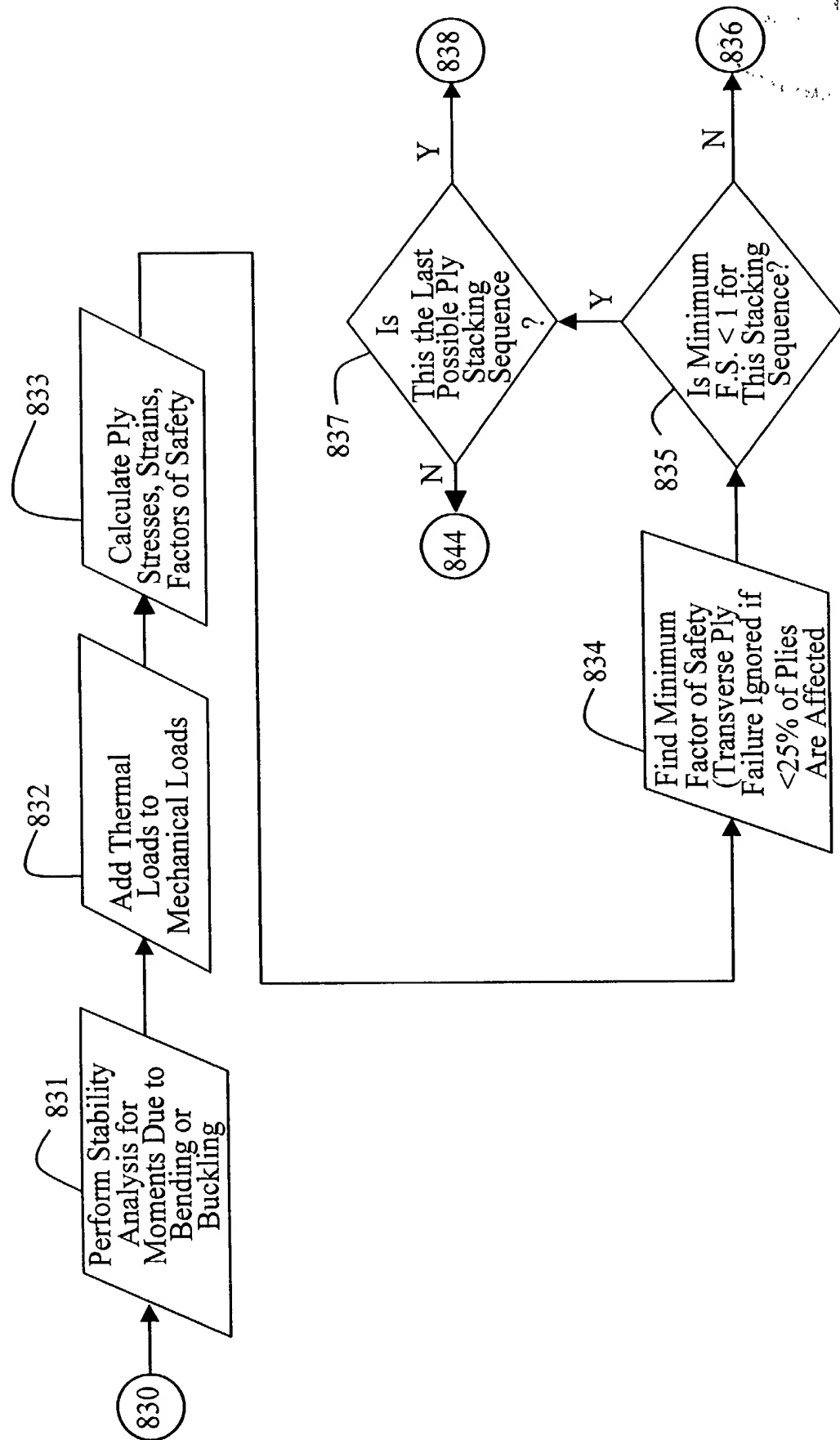
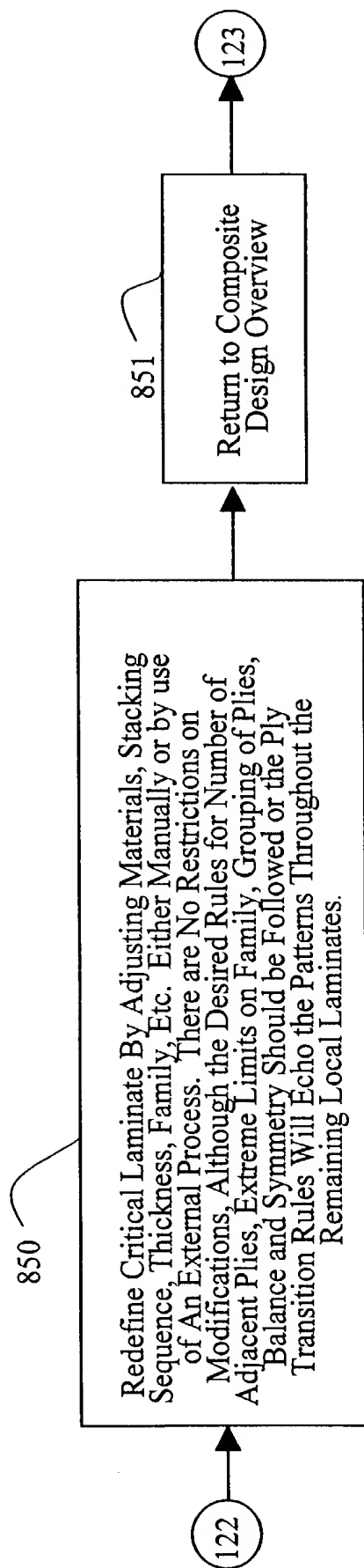


FIG. 16



109897462 1111401

FIG. 17A

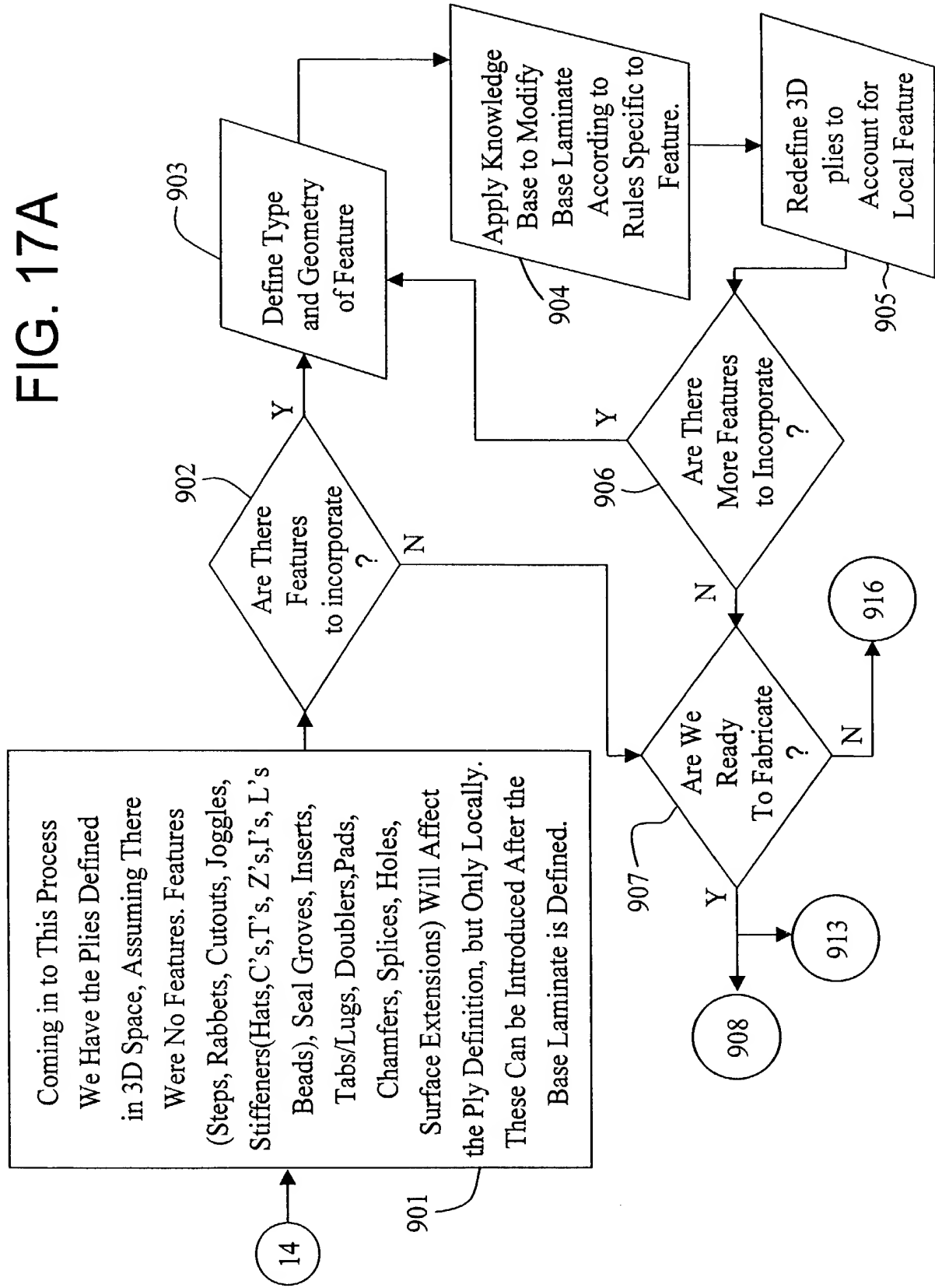


FIG. 17B

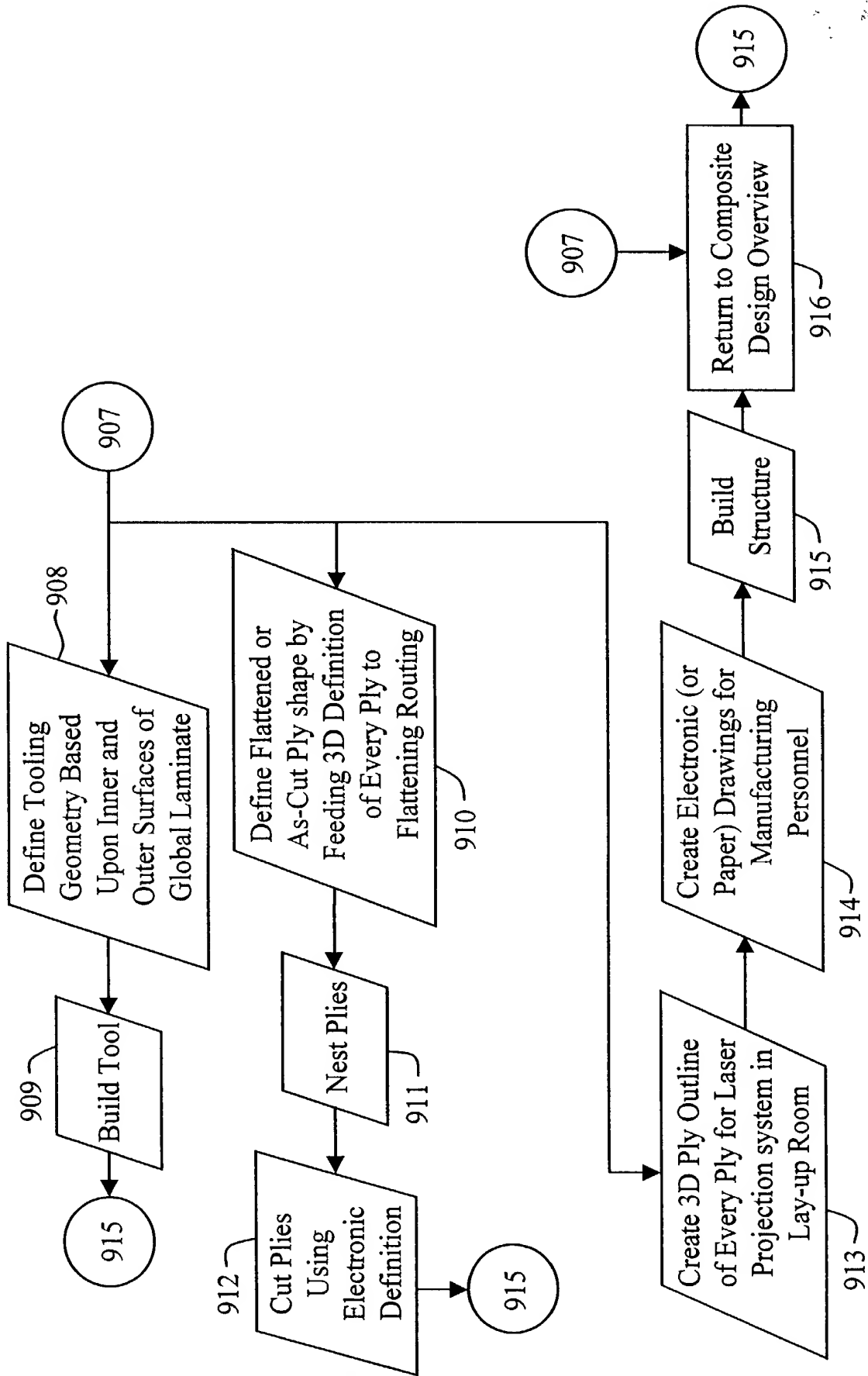


FIG. 19

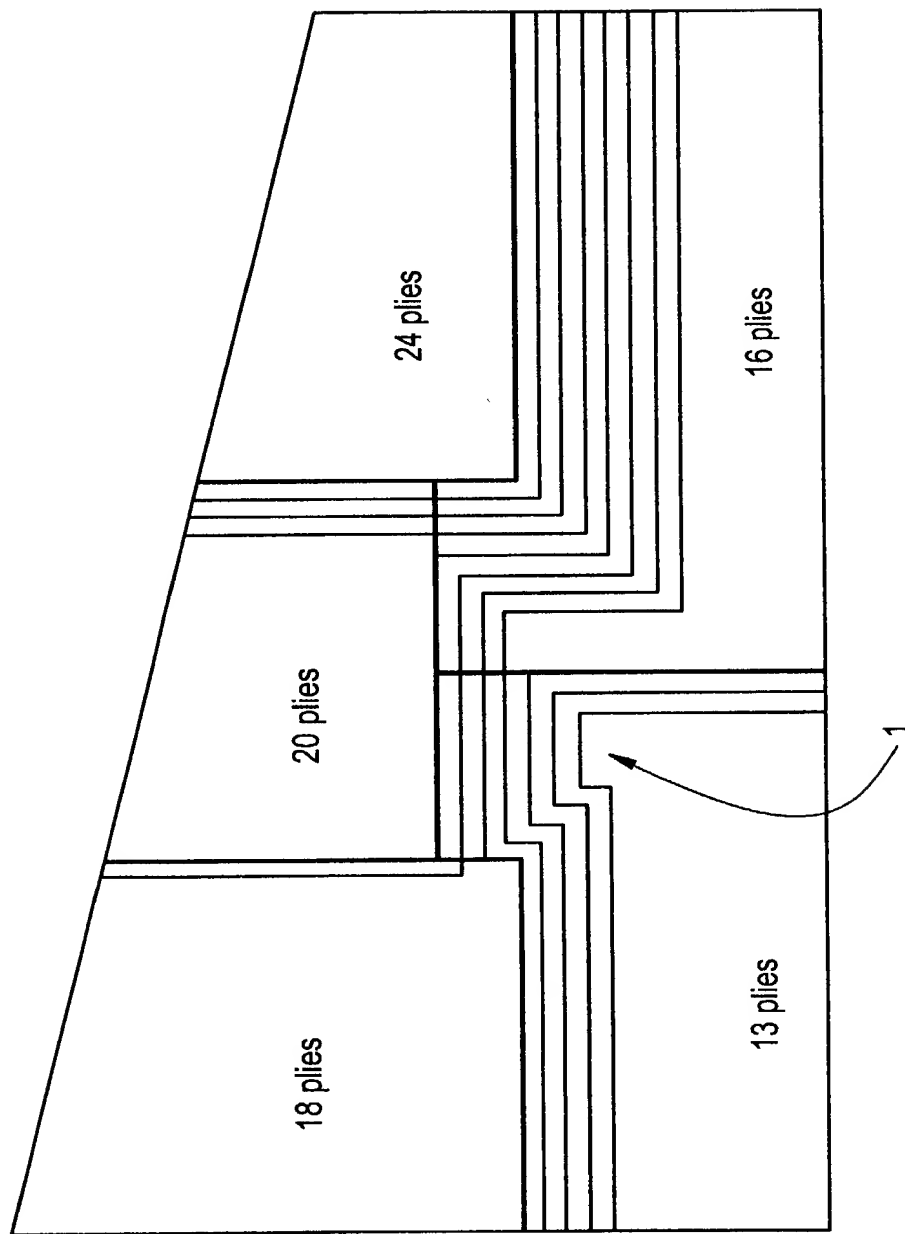
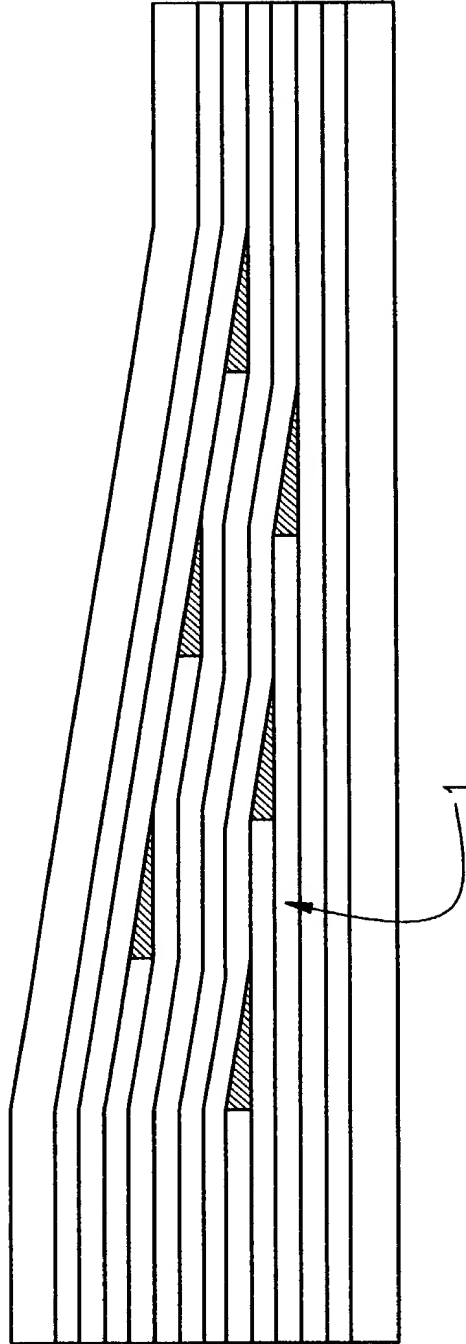
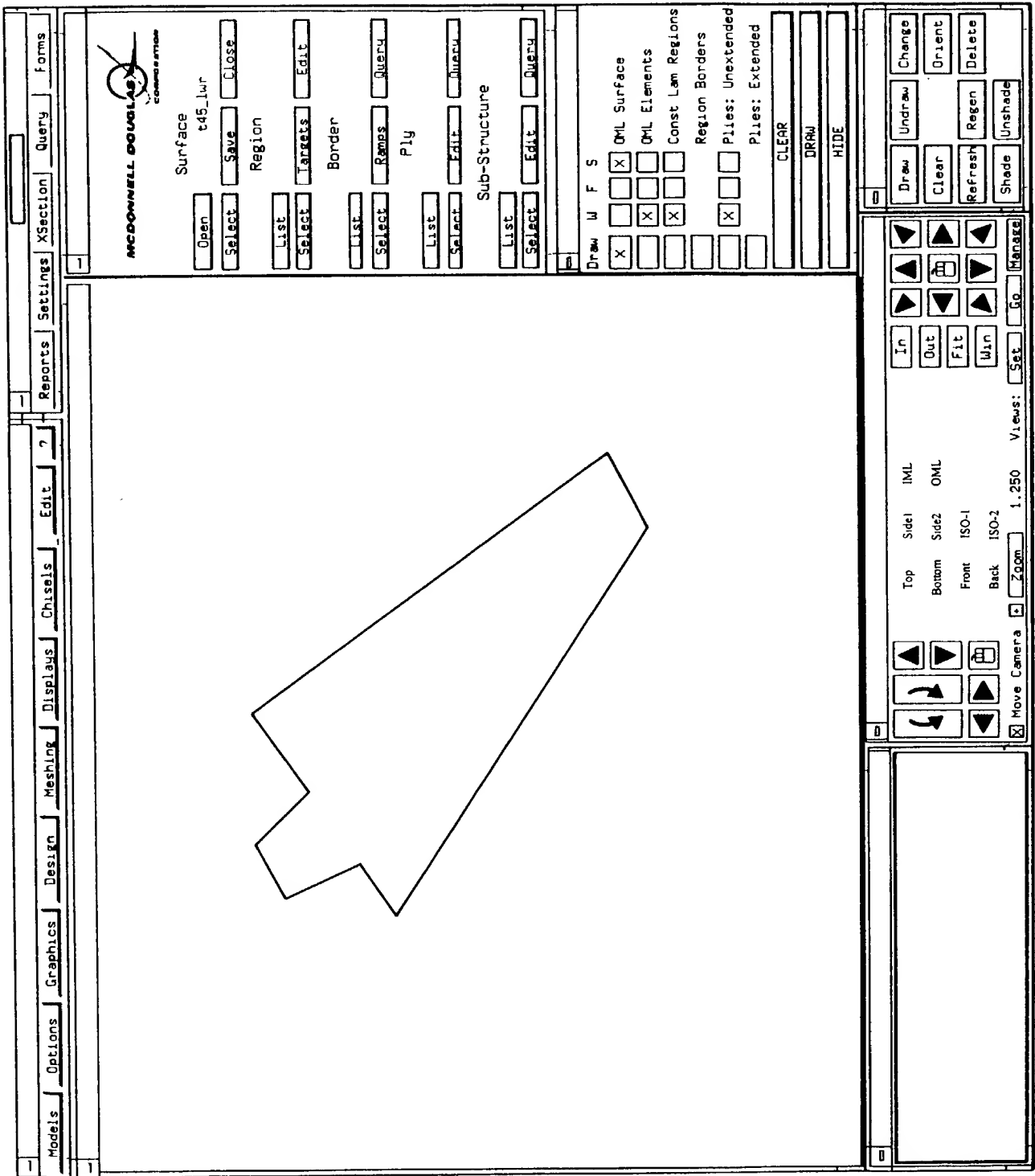


FIG. 21






<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> DML Surface
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> DML Elements
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> Const Lam Regions
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Region Borders
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Plots: Unextended
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Plots: Extended
			CLEAR
			DRAW
			HIDE

The image shows a software interface for a composite structure analysis. The main window displays a schematic cross-section of a structure, labeled "Schematic Cross-Section A-A" and "T45_LWR". The structure is composed of multiple layers, with a central core and outer skins. The layers are labeled with material names and thicknesses. The interface includes a menu bar at the top with options: Models, Options, Graphics, Design, Meshing, Displays, Chisels, Edit, Reports, Settings, XSection, Query, Forms. The right side of the interface contains a toolbar with various icons for navigation and editing. Below the toolbar is a panel with buttons for "In", "Out", "Fit", "Win", "Set", "Go", "Manage", "Top", "Bottom", "Front", "Back", "Zoom", "Move Camera", "IML", "Side1", "Side2", "ISO-1", "ISO-2", "Change", "Undraw", "Clear", "Refresh", "Regen", "Shade", "Unshade", "Orient", "Delete". The bottom of the interface shows a status bar with "Views: 1.250" and "M215876".

Draw	U	F	S
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> OML Surface
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> OML Elements
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Const Lam Regions

FIG. 25

Models Options Graphics Design Meshing Displays Chisels Edit ?
Reports Settings XSection Query Forms



McDONNELL DOUGLAS
CORPORATION

Surface t45_lur

Open Select Save Close

Region

List Select Targets Edit

Border

List Select Rams Query

Ply

List Select Edit Query

Sub-Structure

List Select Edit Query

Draw W F S

☒ ☐ ☐ ☐ OML Surface

☐ ☐ ☐ ☐ OML Elements

☐ ☐ ☐ ☐ Const Lam Regions

☐ ☐ ☐ ☐ Region Borders

☐ ☐ ☐ ☐ Plies: Unextended

☐ ☐ ☐ ☐ Plies: Extended

CLEAR DRAW HIDE

Print Save File

CLOSE

Region Information					
Region	Area	Volume	Weight	# Plies	Thickness
1	311.29	41.09	2.42	12	0.1320
2	56.29	8.02	0.47	13	0.1424
3	60.05	9.80	0.58	15	0.1632
4	58.47	10.15	0.60	16	0.1736
5	79.48	9.66	0.57	11	0.1216
6	144.10	31.01	1.83	20	0.2152
7	41.54	8.51	0.50	19	0.2048
8	40.64	7.90	0.47	18	0.1944
9	39.74	7.31	0.43	17	0.1840
10	38.83	6.74	0.40	16	0.1736
11	74.93	12.23	0.72	15	0.1632
12	36.10	5.52	0.33	14	0.1528
13	46.32	5.63	0.33	11	0.1216
14	17.46	1.94	0.11	10	0.1112
15	1230.88	124.07	7.32	9	0.1008
16	217.05	26.39	1.56	11	0.1216
17	66.04	14.90	0.88	21	0.2256
18	39.59	9.34	0.55	22	0.2360
19	18.46	4.55	0.27	23	0.2464
	2617.26	344.77	20.34	295	

Top Sidel IML

Bottom Side2 OML

Front ISO-1

Back ISO-2

Move Camera ☒ Zoom 1.250 Views: Set Go Manage

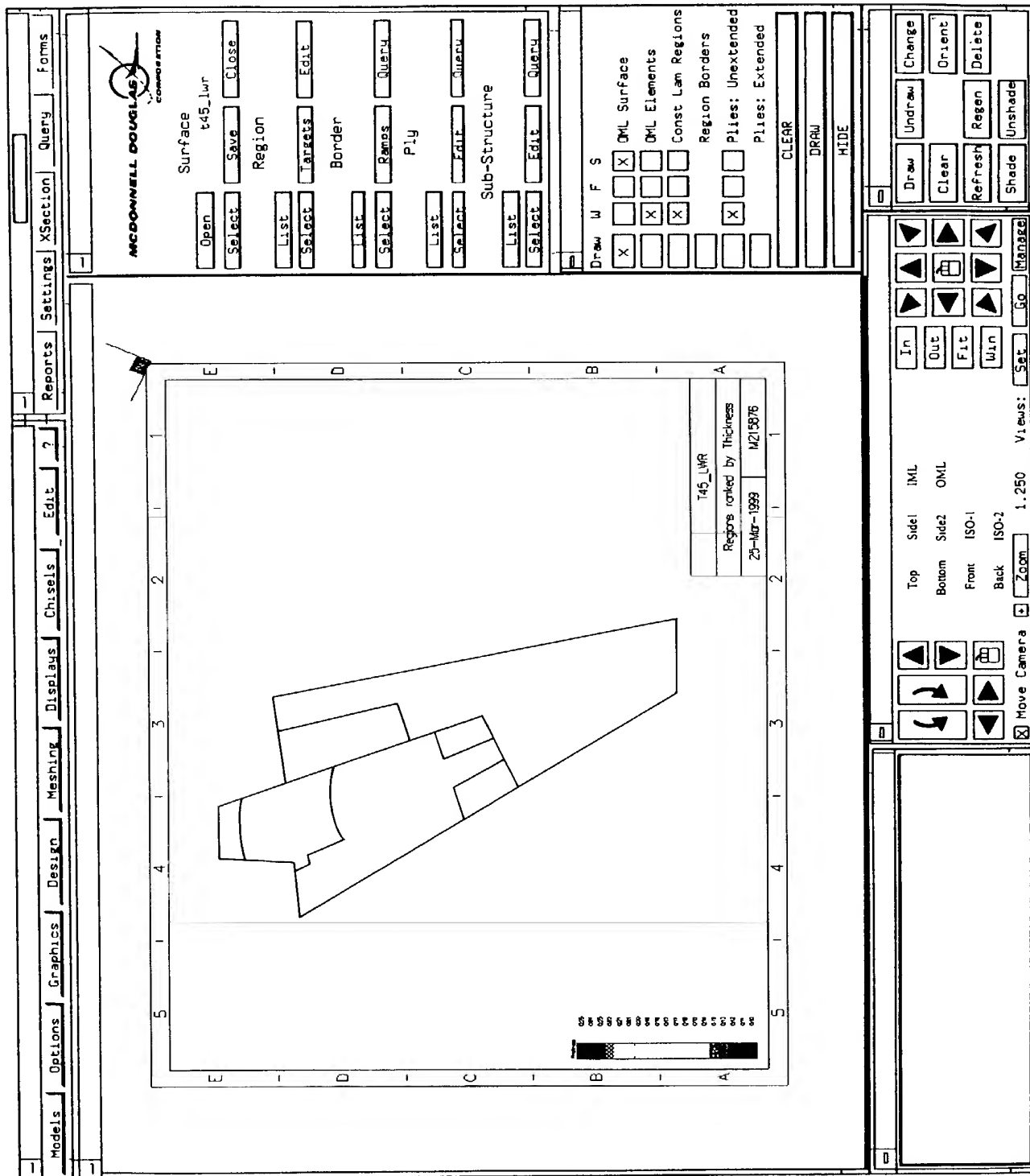
Draw Undraw Change

Clear Orient

Refresh Regen Delete

Shade Unshade

FIG. 26

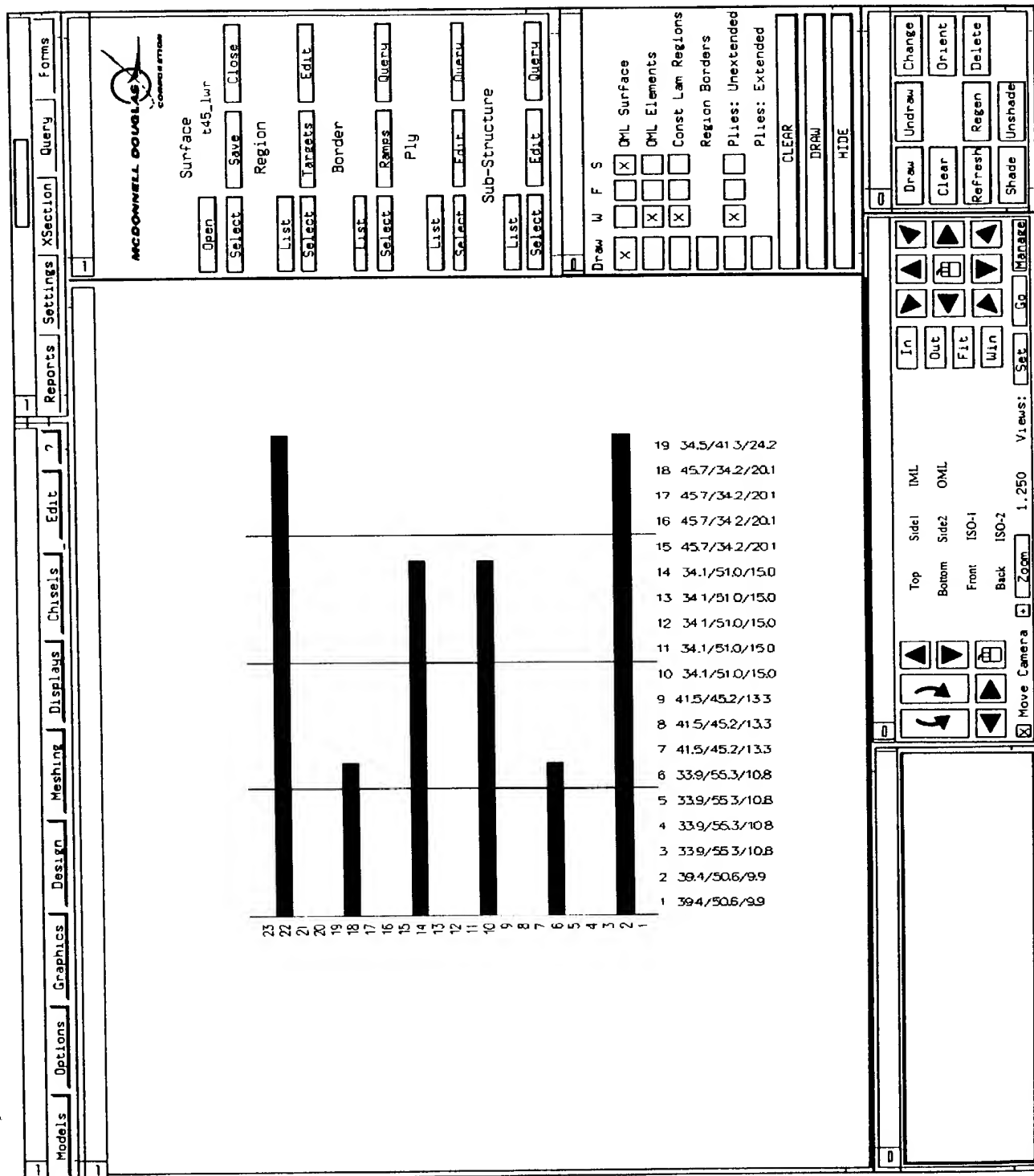


$$\left\{ \begin{pmatrix} x_1 \\ y_1 \end{pmatrix}, \dots, \begin{pmatrix} x_{n-1} \\ y_{n-1} \end{pmatrix} \right\} = \left\{ \begin{pmatrix} x'_1 \\ y'_1 \end{pmatrix}, \dots, \begin{pmatrix} x'_{n-1} \\ y'_{n-1} \end{pmatrix} \right\}$$
[illegible]

[illegible]

4.3

FIG. 29




[illegible]

[illegible]

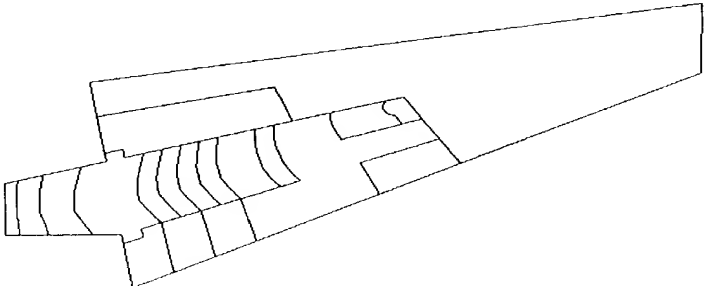
FIG. 32

Models Options Graphics Design Meshing Displays Chisels Edit ?

Reports Settings XSection Query Forms



MCDONNELL DOUGLAS



	3	3.000	66.7/0.0/33.3	[1]
default	0	0.000	0.0/0.0/0.0	[1]
fem-mat-1	14	0.153	22.8/54.5/22.8	[12]
fem-mat-10	15	0.163	34.1/51.0/15.0	[3 11]
fem-mat-11	22	0.236	32.4/52.9/14.7	[18]
fem-mat-12	12	0.132	42.1/31.5/26.4	[1]
fem-mat-13	13	0.142	53.7/29.2/17.1	[2]
fem-mat-14	11	0.122	45.7/34.2/20.1	[5 13 16]
fem-mat-15	10	0.111	31.3/37.4/31.3	[14]
fem-mat-16	9	0.101	34.5/41.3/24.2	[15]
fem-mat-17	0	0.000	0.0/0.0/0.0	[1]

Current

Region

New

Copy

Import

Edit

Delete

Cancel

OK

Material Catalog

Name	Mat1	Form	Type
default	DEFAULT	UNIDIRECTIONAL	PLY
DEFAULT	DEFAULT		
MDC/38			
MDC/46			
MDC/2			
MDC/1			

THIS IS A DEFAULT MATERIAL

Ex	1.0000E+0	Xt	1.0000E+0	t	1.00000
Ey	1.0000E+0	Xc	1.0000E+0	dns	1.0000E+0
Es	1.0000E+0	Yt	1.0000E+0	CTEx	1.0000E+0
NUX	1.000	Yc	1.0000E+0	CTEy	1.0000E+0
Top	Sidel	IML	S		
Bottom	Sid2	OML			

New

front ISO-1

back ISO-2

Locked

OK

Cancel

Move Camera

Zoom 1.250 Views: Set Go Manage

Shade Unshade

FIG. 33

ModelsOptionsGraphicsDesignMeshingDisplaysChiselsEdit7

ReportsSettingsXSectionQueryForms

Laminate Designer

Region:1

Thickness:0.1248

Thickness Bound:0.1248

Target Family:50.0/40.0/10.0

Variation in 0/+45/90:5.0/ 5.0/ 5.0

Minimum Bound:7.0

Maximum Bound:55.0

Adjacent Plies Allowed:2

Within Laminate:2

At Centerline:MDC/I

Material:MDC/I

Material at Surface:No

Apply Loads:1

Stiffness Targets:1

Solutions Targets:Max Strain

Failure Criteria:All

Load Conditions:5

Strength Solutions:

ComputeViewApply

TopSide1IML

BottomSide2OML

FrontISO-1

BackISO-2

In

Out

Fit

Win

Move Camera

Zoom

Set

Go

Manage

Views:1.250

Draw

Undraw

Clear

Refresh

Shade

Unshade

Change

Orient

Delete

05092452 0.1248

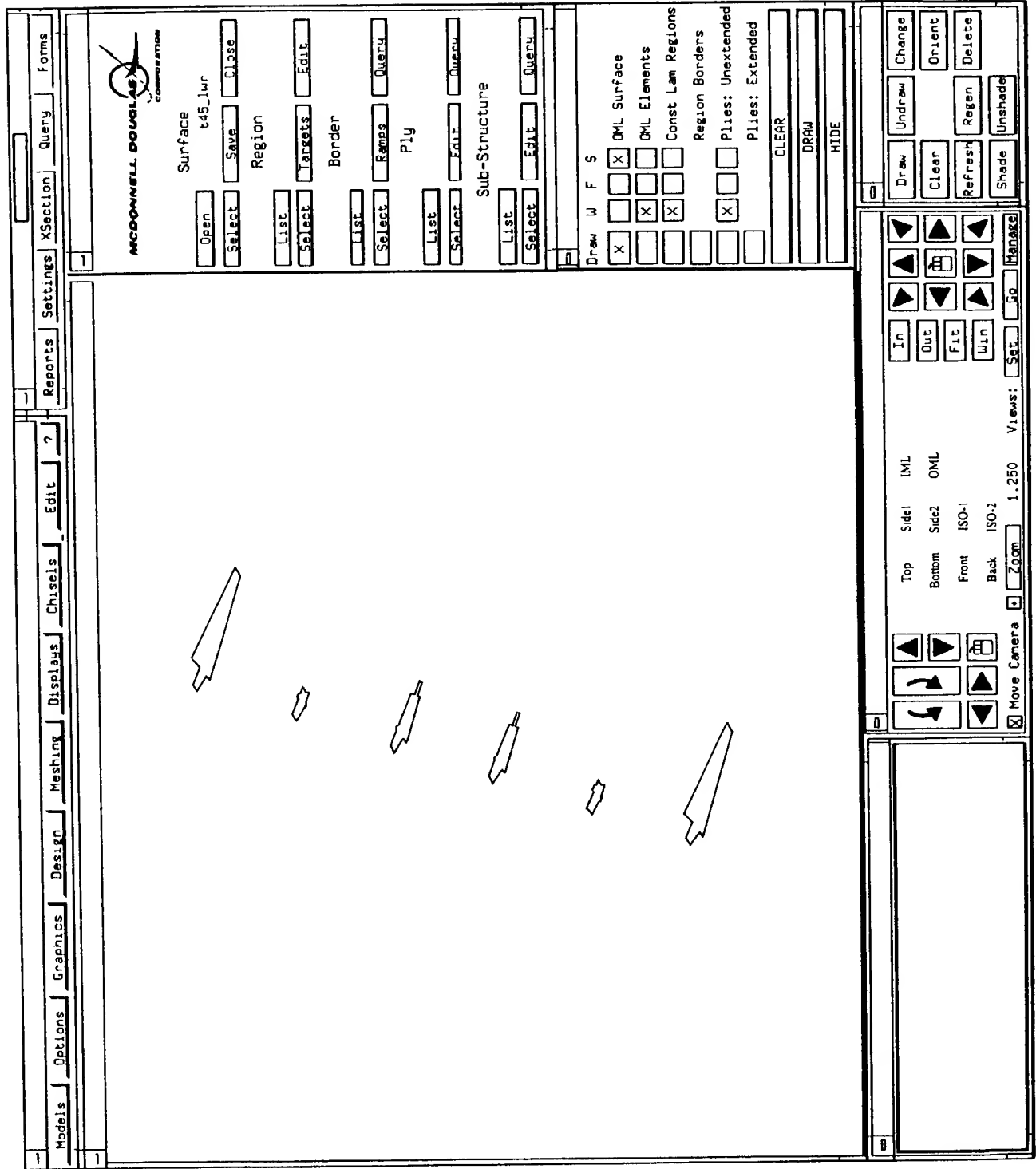


FIG. 34

[illegible]

FIG. 36

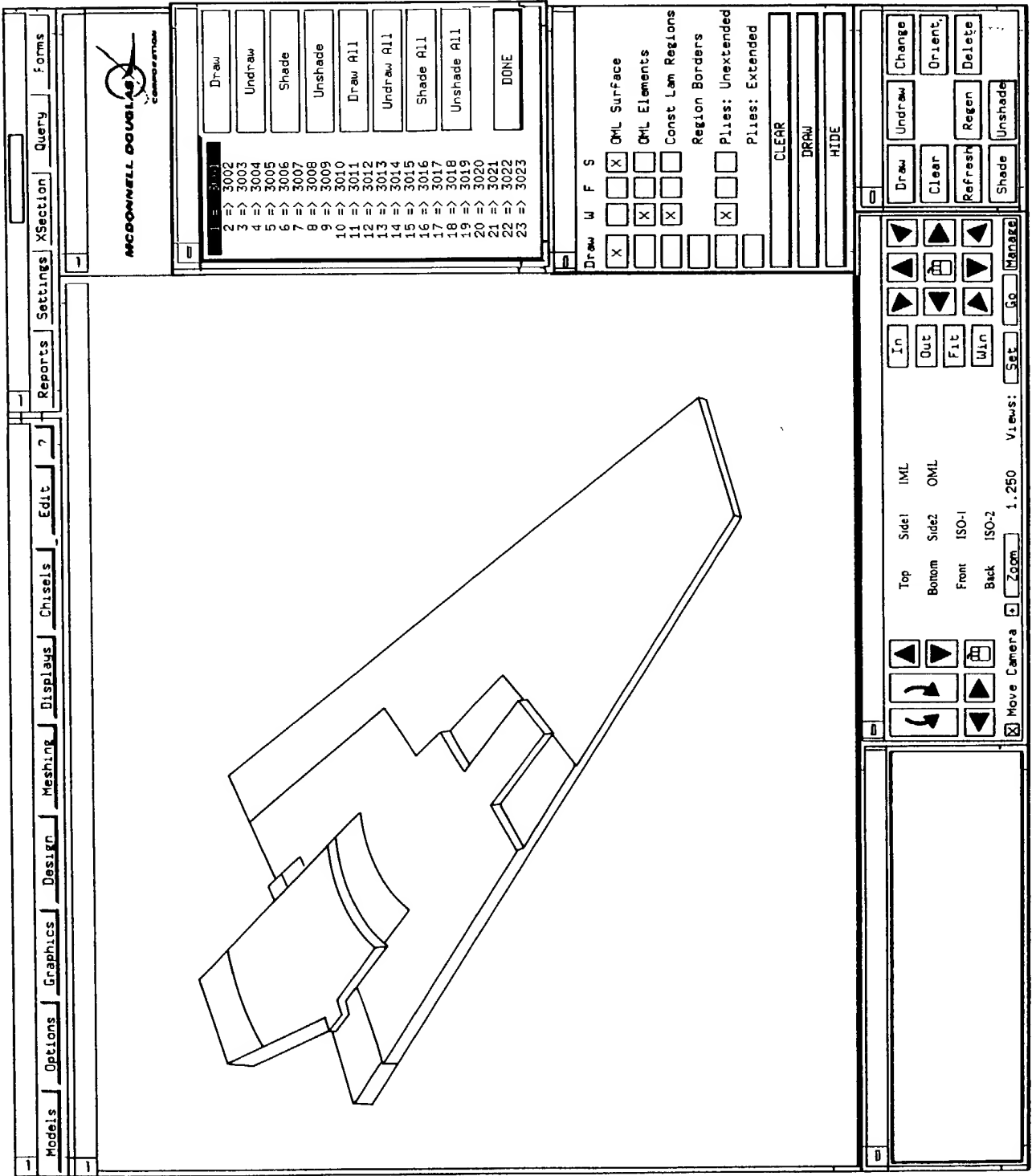


FIG.37

